Vol. XI.
No. CCXLI.] JULY 8, 1882. [Price Fourpence.

JUL 18 1882

THE ELECTRICAL REVIEW

LONDON: NAUGHTON & COMPANY, 10, PATERNOSTER ROW, E.C.
New York: D. Van Nostrand, 23, Murray Street, and 27, Warren Street. Paris: E. Barbier, 33, Quai de l'Horloge;
Madame Veuve J. Boyveau, Librairie Etrangère, 22, Rue de la Banque. Berlin: A. Asher & Co., 5, Unter den Linden.

JOHNSON & PHILLIPS,
TELEGRAPH ENGINEERS, ELECTRICIANS, AND CONTRACTORS.
OFFICES: 14, UNION COURT, OLD BROAD STREET, LONDON, E.C.
WORKS: VICTORIA ROAD, CHARLTON, LONDON, S.E.

Manufacturers of all Telegraph Appliances, Materials, and Machinery for Making and Laying Submarine Cables, and Contractors for Underground & Aerial Telegraphs.

Iron and Steel Telegraph Buoys, Grapnels, both Patent and Ordinary; Centipedes, Crampers, Mushrooms, Sinkers, Cable Tanks, Picking-up and Paying-out Machinery, Dynamometers, Bow and Stern Gear, Steam and Hand Hauling Gears, Rope and Chain Fittings, Cable Drums, Splicing and Jointing Tools, &c., &c.

Machinery Designed and Constructed for the Complete Equipment of Telegraph Cable Factories and Vessels. Wire Testing Machines for Tension, Elongation, and Torsion. Special Wire Sounding Machines for Shallow and Deep Water.

All Apparatus and Material used in the Construction and Maintenance of **LAND LINES**, viz.:—

INSULATORS—*Johnson & Phillips'* Patent Fluid Insulators, and all kinds of the ordinary form, Shackles, Shackle Straps, &c.

BATTERIES—Sole Makers of *Higgins'* Patent Bichromatic Batteries, and all the ordinary forms. Contractors for the supply of Zinc and Carbon Battery Plates of special quality.

POLES—Wrought Iron or Composite Poles of various kinds, for Telegraph, Telephone, and Electric Light purposes.

Makers of Special Underground Torpedo and Field Cables, with Single or Multiple Cores.

Insulated Copper Wires, Strand and Ropes, taped or braided, cotton or silk covered.

ELECTRIC LIGHT—Makers of Brockie's Electric Lamp.
Every description of Leading WIRES and CABLES. CARBON RODS, both Black and Coppered.

SOLE MAKERS OF VYLE'S PATENT EASILY TESTED LIGHTNING CONDUCTORS.

HOOPER'S TELEGRAPH & INDIA RUBBER WORKS,
OFFICES:—31, LOMBARD STREET, LONDON, E.C. WORKS:—MITCHAM AND MILLWALL DOCKS.

MANUFACTURERS OF SUBMARINE AND SUBTERRANEAN TELEGRAPH CABLES
UNDER HOOPER'S PATENTS.

MEDAL OF PROGRESS, 1873.

CONTRACTORS TO
HER MAJESTY'S WAR OFFICE,
ADMIRALTY AND INDIA OFFICE,
AND TO THE CONTINENTAL GOVERNMENTS.

GOLD MEDAL 1867.

ELECTRIC LIGHT WIRES.

GOLD MEDAL 1881, PARIS ELECTRICAL EXHIBITION.

THE "PILSEN"-JOEL AND GENERAL ELECTRIC LIGHT COMPANY,
LIMITED.

PATENTEES AND MANUFACTURERS OF
THE PILSEN ARC LAMP, THE JOEL SEMI-INCANDESCENT LAMP, AND THE GATEHOUSE INCANDESCENT LAMP.

Manufactory: THE MALDEN FACTORIES, KENTISH TOWN, N.W.,
H. F. JOEL, A.M.I.C.E., Engineer.
E. T. [illegible], Secretary. JAMES PYKE, Managing Director.

TEMPORARY OFFICES—65, QUEEN VICTORIA STREET, E.C.

Contractors to H.M. Postmaster-General, the Indian Government, the principal Railway, Telephone, and Electric Light Companies.

ESTABLISHED 1868.

WALTER T. GLOVER & Co.,
Telegraph Wire and Cable Makers,
25, BOOTH STREET, MANCHESTER.

INDEX TO THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW ADVERTISEMENTS.

No charge is made for inserting the Names of firms whose advertisements are ordered for a series of insertions in this Journal during the continuance of such advertisements.

(The numbers refer to the page on which the displayed advertisement will be found.)

PAGE
Cabinet Work.
G. Beach 8
W. M. [illegible] 3
Clock Synchronising.
Barraud & Lunds... 6
Educational.
School of Telegraphy 10
Electrical Engineers and Contractors.
Callender's Bitumen Telegraph, &c., Co. 7
W. T. Henley 5
Hooper & Co. 1
India-rubber and Telegraph Works Co. 12
Johnson & Phillips 1
E. Paterson 11
Electric Light.
J. Edmundson & Co. (Swan) 5
Edison Electric Light Co., Limited ... 7
Griffith & Co. 4
Pilsen-Joel and General Electric Light Company, Limited 2
Engines for Electric Light.
Peter Brotherhood 6
Insulators.
Bourne & Co. 5
David Brooks 3
G. Johnson & Sons 4
Stiff & Sons 4
Lightning Conductors.
Newall & Co. 9
Machinery.
Thos. Barraclough & Co. (Limited) ... 5
Manufacturing Electricians.
T. Crampton & Co. 4
J. T. Gent & Co... 4
J. Orme & Co. 8
F. A. Stevens 8
Patent Agents.
E. P. Alexander 6
H. Gardner 8
Publications.
Berly's "Electrical Directory" 3
"Railway Supplies Journal" 8
PAGE
Photographic.
Wratten & Wainwright 9
Screws.
Davis & Timmins... 10
International Machine Company ... 4
Telephones.
W. C. Barney 10
Blakey, Emmott & Co. 6
Harrison, Cox-Walker & Co. 9
Swiss Telephone Company 11
M. Theiler & Sons 6
Wood Engraver.
R. A. Chaffins 4
Wire (covered).
W. T. Glover & Co. 2
London Electric Wire Company ... 9
Phillips Brothers 11
Wire (uncovered).
Cooke & Co. 5
R. Johnson & Nephew 8
Ramsden, Camm, & Co.... 7
F. Smith & Co. 8
Webster, Horsfall & Lean 9

THE TELEGRAPHIC JOURNAL AND

ELECTRICAL REVIEW.

VOL. XI. JULY 8, 1882. No. CCXLI.

CONTENTS:

	PAGE
Electric Light Apparatus	1
The Electric Light at the Telegraph Office and at the Station of North Brussels. By M. J. Dumont (*illustrated*)	2
Fire Risks from Electric Lighting (*illustrated*)	7
The Baudot Telegraph (*illustrated*)	8
On the Reaction-current of the Electric Arc	10
The Telegraph Engineers' Society and the Electric Light	11
Arc Electric Lights for Large Indoor Spaces	11
The Electric News-Telegraph Company	11
Correspondence :—	
Dynamo-electric Machines	12
Notes	12
New Patents, 1882	17
Abstracts of Published Specifications, 1881 and 1882	17
City Notes	20
Quotations	20

PATENT OFFICE.

H. GARDNER,

166, FLEET STREET,

LONDON.

Successor to
Messrs. ROBERTSON, BROOMAN & Co.,

Gives prompt personal attention, and obtains Patents for Inventions, Protection for Trade Marks, &c., at fixed and moderate charges.

PAMPHLET OF COSTS GRATIS.

Thirty Years' Practical Experience.

Provisional Protection, £8.

WILLIAM M. FOXCROFT,

Telegraph Instrument Case Manufacturer,

54, COMPTON ST., CLERKENWELL.

INSTRUMENT CASES OF ALL DESCRIPTIONS.

Wholesale Maker of the Gower-Bell Telephone Case as adopted by Her Majesty's Government.

Lock and Block, Single Needle, Bell, Sounder, and Perforator.

PRIZE MEDAL, PARIS, 1881.

CABINET WORK DESIGNED TO SUIT NEW INSTRUMENTS.

RICHARD JOHNSON & NEPHEW,

MANCHESTER.

TELEGRAPH AND TELEPHONE LINE WIRE.

LONDON OFFICE:

8, GREAT WINCHESTER STREET, E.C.

GEORGE BEECH,

Telegraph Instrument Case Manufacturer by Steam Power,

109, DALSTON LANE, KINGSLAND.

Railway and Telegraph Engineers supplied with every description of Telegraph Instrument Cases, Single Needle, Block, Bell, Switch, &c. The material and workmanship of first quality and guaranteed. (Established 1872.)

Drawings for New Designs got out for approval.

J. A. BERLY'S BRITISH AND CONTINENTAL ELECTRICAL DIRECTORY AND ADVERTISER FOR 1882 is now published at J. A. BERLY'S, 16, New Bridge Street, London, E.C. Price, 5s.; by Post, registered, 5s. 6d.

F. A. STEVENS,

Electric Bells and Batteries Manufactured, Wholesale and Retail.

18, DUKE STREET, SMITHFIELD, E.C.

Price List Free.

FREDERICK SMITH & Co.,

Contractors to H.M. Postmaster-General,

CALEDONIA WORKS, HALIFAX, ENGLAND.

SPECIALITIES:

PATENT GALVANISED

Galvanised Strand Wire.
Stay Wire (special).
3/16 Strand High Conductivity.
Patent Galvanised Binding Wire.
Line Wire to all Specifications.

Cable Wire.
Patent Steel Wire for Hawsers and Deep-Sea Sounding Lines.
Galvanised Patent Steel Wire for Long Spans.

WITHOUT JOINT OR WELD.

Prize Medals :—London, 1862 ; Paris, 1867 ; Moscow, 1872 ; Vienna, 1873 ; Paris, 1878 ; Philadelphia, 1876.

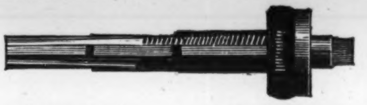
TELEGRAPH CABLE MAKING MACHINERY
Suitable for every description of Cables (Land and Submarine).

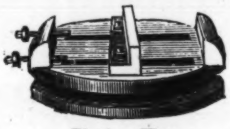
WIRE STRANDING MACHINES
For making Telegraph Strand with any number of wires from 3 to 19.
CORE SERVING MACHINES of all sizes.
TAPING MACHINES, Single and Double.
WIRE COVERING MACHINES of every description for covering wire with india-rubber, gutta-percha, hemp, flax, cotton, silk, &c.
COMPLETE SETS of Machine for purifying and preparing INDIA-RUBBER and GUTTA-PERCHA for Telegraphic purposes.
Estimates furnished on application. For Plans of Works a fee is charged proportionate to the labour involved.

THOMAS BARRACLOUGH & Co., Limited, 8, King Street, Manchester.

GRIFFITH & Co.,
(Late Harborow & Co.),
ELECTRIC LIGHT ENGINEERS,
AND
TELEGRAPH INSTRUMENT MANUFACTURERS,
4, QUEEN ANNE'S GATE, S.W.

THE INTERNATIONAL MACHINE Co.,
118, Whitehorse Street, Commercial Road, London, E.





Planing Vices.

THE UNIVERSAL
Expanding Lathe Mandril,
FOR TURNING, ETC.,
Will hold rings, &c., perfectly true, of any size within the limits for which it is made.
DUPLEX LEVER PUNCHING BEARS.

PRIZE MEDAL, PARIS ELECTRICAL EXHIBITION, 1881.

J. STIFF & SONS,
LAMBETH, LONDON,
MANUFACTURERS OF
POROUS CELLS AND PLATES,
BATTERY JARS,
TELEGRAPH INSULATORS,
Chemical Apparatus, Art Stoneware,
PLUMBAGO, CRUCIBLES, &c.

G. JOHNSON & SON,
IMPORTERS AND REFINERS OF
PARAFFINE WAX
Of high melting point, and prepared with special regard to Insulating Property.

BLACK EARTH WAX, CRUDE AND REFINED.

BEES' WAX, YELLOW AND BLEACHED.

Stearine, Spermaceti, &c., at lowest Wholesale rates.

175, BISHOPSGATE ST. WITHOUT, 175
LONDON.

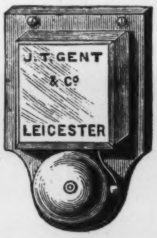
ELECTRICAL & SCIENTIFIC APPARATUS.

Manufacturers of Electric Bells, Indicators, Constant Batteries, Telephone Switches and Transmitters, Induction Coils, Terminals, Carbons, Wires, &c.

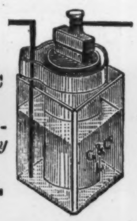
COMPLETE CATALOGUE, TWO STAMPS.

THOMAS CRAMPTON & CO.,
MANUFACTURING ELECTRICIANS AND OPTICIANS,
251, HIGH HOLBORN, LONDON, W.C.

J. T. GENT & Co.,



LEICESTER,
Manufacturers of
ELECTRIC, PNEUMATIC,
and ELECTRO-PNEUMATIC
BELLS and PENDULUMS,
Mining Signals, Lightning Conductors, Insulated Wires of every description.
RAILWAY TELEGRAPH STORES.
Batteries, Pushes, and other Electrical Apparatus.



ELECTRICAL & SCIENTIFIC APPARATUS.
WHOLESALE MANUFACTURERS OF
ELECTRIC BELLS, ELECTRIC REVERSING INDICATORS,
"ARC" LAMPS,
TELEPHONE SWITCHES & TRANSMITTERS,
New "Granule" Battery, Constant and Powerful Coils,
Vacuum Tubes, Terminals, Carbons, Wire, and all Materials.
INSTRUMENTS MADE, REPAIRED, OR ALTERED ON THE PREMISES.
New Edition, complete Illustrated Catalogue of Electric Appliances and Materials, 72 pp., post free four stamps.
SPECIAL QUOTATIONS TO THE TRADE.
H. & E. J. DALE,
Manufacturing Electricians, 4, Little Britain, London, E.C.

Estimates given and Contracts taken for all kinds

ARTIST PHOTOGRAPHER & ENGRAVER
ENGRAVING CAREFULLY
R. A. Cheffins
ON WOOD
EXECUTED IN ALL ITS BRANCHES
OFFICE 9, Essex Street Strand

of Newspaper and Commercial Work.

W. T. HENLEY'S TELEGRAPH WORKS CO.,
LIMITED,
TELEGRAPH ENGINEERS & CONTRACTORS.

MANUFACTURERS OF SUBMARINE CABLES
AND TELEGRAPHS OF ALL KINDS.

TELEGRAPH WIRES AND STORES OF EVERY DESCRIPTION.

8, Draper's Gardens, Throgmorton Street, London.
WORKS—NORTH WOOLWICH.

JOSEPH BOURNE & SON,
MANUFACTURERS OF THE WELL-KNOWN
STONEWARE TELEGRAPHIC INSULATORS AND BATTERY JARS.

For Thirty years these manufactures have been celebrated for a high degree of vitrefaction combined with great toughness and strength.
Brown Stoneware. White Stoneware. Brown Porcelain. Porous Cells.
Economy, Strength, and Durability combined. *Prize Medal, Paris Electrical Exhibition.*
Works: DENBY POTTERY, NEAR DERBY.
London Office: 6, ST. PANCRAS STATION, EUSTON ROAD, N.W.

THE BROOKS' PATENT INSULATORS
WERE AWARDED THE FIRST PREMIUM
At the PARIS EXPOSITION of 1867, at the VIENNA EXPOSITION, 1873, at the CINCINNATI INDUSTRIAL EXPOSITION in 1874, and at the CENTENNIAL EXPOSITION at PHILADELPHIA in 1876.
These INSULATORS are being largely used by the WESTERN UNION and AMERICAN UNION TELEGRAPH COS.

MANUFACTURED AND FOR SALE BY
DAVID BROOKS,
22, SOUTH TWENTY-FIRST STREET, PHILADELPHIA.

THE "SWAN" INCANDESCENT LIGHT.

J. EDMUNDSON & CO., having been appointed as Agents in London for the Exhibition and Sale of the SWAN INCANDESCENT ELECTRIC LIGHT, are prepared to furnish Estimates for Supplying and Fitting up these Lamps complete, with all necessary apparatus.

J. EDMUNDSON & CO.,
ENGINEERS AND ELECTRICIANS,
19, GREAT GEORGE STREET, WESTMINSTER, S.W.

WM. COOKE & CO.,
LIMITED,
The TINSLEY STEEL, IRON, and WIRE WORKS,
SHEFFIELD.

SYDNEY EXHIBITION. { Award............FIRST DEGREE OF MERIT.
Report............ALL ARTICLES OF SUPERIOR QUALITY, as exhibited by Sections of Bends and various Manufactures.
MELBOURNE EXHIBITION, 1880. FIRST AWARD FOR ALL EXHIBITS.
THE ONLY ENGLISH HOUSE WHICH OBTAINED A FIRST-CLASS AWARD FOR WIRE.
Bessemer Steel and Best Puddled and Charcoal Iron Rods, **GALVANISED TELEGRAPH** and **CABLE WIRE,** Steel and Iron Fencing and Strand Wire, Merchant Iron of all descriptions, and Best Homo. Yorkshire Iron for Engineering purposes. Telegraph Wire to British Government tests, in 100 lb. pieces, without weld or joint.

LONDON OFFICE, 110, CANNON STREET, E.C. MANCHESTER OFFICE, 3, SPRING GARDENS.

BARRAUD & LUNDS,

41, CORNHILL, E.C.

PATENTED METHOD OF

SYNCHRONISING CLOCKS,

XII XII

Which keeps invariably set to Mean Time all Clocks electrically connected.

THE FOLLOWING TELEGRAPH AND RAILWAY COMPANIES HAVE ADOPTED THE SYSTEM:—

EASTERN TELEGRAPH COMPANY.
ANGLO-AMERICAN TELEGRAPH COMPANY.
INDO-EUROPEAN TELEGRAPH COMPANY.
PARIS AND NEW YORK TELEGRAPH COMPANY.
GREAT NORTHERN TELEGRAPH COMPANY.
AMERICAN CABLE COMPANY.
GREAT EASTERN RAILWAY.
METROPOLITAN RAILWAY.
MIDLAND RAILWAY.
LONDON AND NORTH-WESTERN RAILWAY

Provincial and Foreign Concessions arranged on terms to be obtained on Application.

OFFICE FOR PATENTS,
36, SOUTHAMPTON BUILDINGS, LONDON, W.C.

Mr. E. P. ALEXANDER,

Consulting Engineer and Patent Agent,

CONTINUES TO OBTAIN

BRITISH, COLONIAL, AND FOREIGN PATENTS FOR INVENTIONS.

M. THEILER & SONS,

MANUFACTURING ELECTRICIANS AND TELEGRAPH ENGINEERS,

86, CANONBURY ROAD, LONDON, N.
MANUFACTORY: 1, ALWYNE LANE, N.

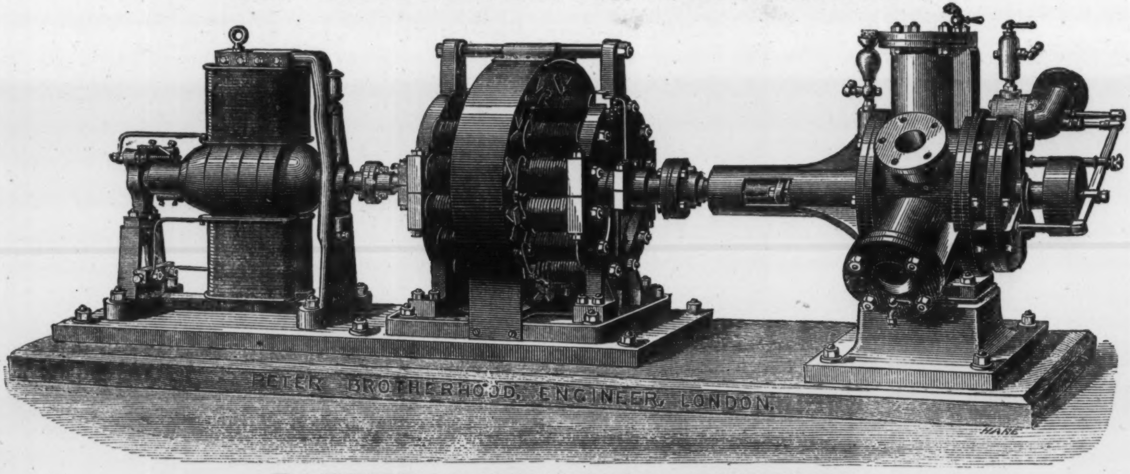
SPECIALITIES: Inking Morses, Type Instruments, P. O. Standard Relays, Cable Relays, Duplex and Quadruplex Apparatus, Fire Alarms, Electric Motors.

TELEPHONE SWITCH BOARDS AND MAGNETO BELLS OF SUPERIOR CONSTRUCTION.

AWARDED GOLD MEDAL FOR TELEGRAPH INSTRUMENTS, MELBOURNE INTERNATIONAL EXHIBITION, 1881.

PETER BROTHERHOOD,

MECHANICAL ENGINEER,
BELVEDERE ROAD, WESTMINSTER BRIDGE, LONDON, S.E.
PARIS: HENRY CHAPMAN, Esq., 10, RUE LAFFITTE.



PATENT 3-CYLINDER ENGINES

As supplied for driving SIEMENS' Dynamo Machines for Cunard Steamers "Servia," "Cephalonia," "Pavonia," SS. "Faraday," "Manapouri," "Goorkha," "Wairarapa," new Channel Steamer "Invicta," &c., &c.

Intending purchasers of High-speed Engines, for Driving Dynamo Machines of any class, or for other purposes, are invited to inspect the BROTHERHOOD Engines at work at the above address.

THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. XI.—No. 241.

ELECTRIC LIGHT APPARATUS.

THE interest felt by all classes in the introduction of the electric light for household purposes is now so universal that the one great question is, "When shall we be able to have this light in our houses?" At present this is rather a difficult matter to deal with, for, notwithstanding all that has been gone through by the Parliamentary Electric Light Committee, we are now at a standstill as far as any important operation is concerned towards solving the problem of domestic illumination. Several well-known gentlemen with unlimited funds have provided for themselves the necessary apparatus wherewith to light their own mansions by means of the incandescent electric lamps, the result, after the first cost, being eminently satisfactory; but the laying down of the necessary plant involves the outlay of a considerable sum, and it is this first expense which is keeping back many who would otherwise invest in a private installation of the electric light. It would really be worth the consideration of electric light companies to endeavour, by a different design, or proportioning of the various parts of dynamo-electric machines, to materially cheapen them, so that the evident desires of many private persons with tolerably good incomes could be met. M. Marcel Deprez has lately demonstrated, both theoretically and experimentally, that a magnetic field of given intensity is least expensive to obtain when it is produced by electro-magnets of considerable dimensions, and he recommends the employment of very powerful inducers surrounded with a *moderate quantity* (the italics are ours) of wire.

It is the wire for winding the bobbins and electro-magnets of these machines which constitutes the most expensive item in their construction, and we quite believe that the electro-magnets may be made much more cheaply and yet be equally as efficient as those now employed. As far as arc electric lamps are concerned, it is not probable that they will trench upon the subject of domestic illumination beyond a slight degree; but as they, too, have their special uses, cheapness in their construction is most desirable. Apparently the lamps of this type which have had the greatest sale have been the most costly, but it is easy to imagine that the demand for them would have been more than quadrupled had their price been reduced to one-fourth of their present scale. There is, however, every possibility of great reduction on this point, for there is, at least, one lamp lately brought before the public which can be made for a few shillings, and will last in action thirty or forty hours without recharging. Even presuming that the use of such a lamp entails the cost of 10 or 20 per cent. extra horse-power, its enormously reduced first cost and ease of manipulation will outweigh such consideration, more especially where the supply of power is unlimited. The question of consumption of carbon, and also of the manufacture of the carbon itself, is of the greatest importance. It will be seen, in the description of the illumination of the North Brussels Telegraph Office in our other pages, that of many experiments with retort and artificially-produced carbons, the best results were obtained with the former. Of course, gas carbon could not economically be used with the ordinary arc lamps; therefore, any system which can employ short and roughly-shaped pieces of gas carbon has a certain advantage over those which necessarily burn carbons artificially made. The manufacture of incandescent lamps has made more progress towards the end in view than any other part of an electric light system; and on the score of expense there is certainly but little to complain of, considering their lasting capabilities, when not forced beyond a normal illuminating power.

The expense attached to the employment of incandescent lamps has been reduced during the last twelve months about five times. This is due to a variety of causes, the principal being, perhaps, the fact that experimental work in this direction can be much more easily carried out than in the case when machines are the subject of investigation. In England, at least, we are deeply indebted to the labours of Messrs. Swan and Lane-Fox, who are practically the pioneers of this branch of electric lighting, and it should be remembered that, whatever improvements may have been made since by others, their path has been rendered easy by the labours of the two gentlemen mentioned.

The cost of conducting wires forms another heavy item in the sum total of a system of electric lighting, yet we have every reason to believe that this will be within a short period reduced nearly 50 per cent. The supply of gutta-percha and india-rubber as insulating materials is limited even now, and it is likely that their cost will be materially increased by the demands for electric light leads. It is therefore necessary that other materials be sought for to answer the same purpose, and this is in a very fair way of being satisfactorily accomplished. The motive power as supplied by steam engines for driving dynamo-electric machines is already established on as economical a basis almost as may be expected, but improvements in gas-engines will doubtless continue for some time to come. But it is not so much to improvements in the apparatus producing our motive power, as to the cheapening of the electrical part of the installation, that we must look to for the increased development of electric lighting. It is quite right and business-like on the part of any company with plenty of work in hand to keep up high prices; but it is no reason why new competitors in the same field should try to emulate the method adopted by the commercially successful company. It is the very object of competition to bring prices down to such a level that both manufacturers and the public receive their fair dues. It is necessary when the demand for certain articles is limited to charge accordingly, but when the demand is likely to become universal, it becomes policy on the part of those supplying the articles to encourage the desire of the public, and not to paralyse or stave it off by the exorbitant sums required for the apparatus. That the wished-for result will arrive sooner or later is a matter of course, but at present electric light companies, with one or two exceptions, show too much apathy towards the very object of their formation, and rapid progress therefore is scarcely to be looked for.

THE ELECTRIC LIGHT AT THE TELEGRAPH OFFICE AND AT THE STATION OF NORTH BRUSSELS.

By M. J. DUMONT, Engineer to the Administration of Telegraphs.

THE present report gives an account of the experiments in electric lighting at the three rooms occupied by the *employés* of the telegraphic department at the station of North Brussels.

The trial, sanctioned on the 20th September, 1879, by the director-general of posts and telegraphs, commenced on October 28th following, on which date the instrument-room was lighted by two Jaspar lamps. Towards the middle of January, 1880, the lighting was extended to the little room and to the office in which are placed the desk of the superintendent, the cage of the elevator, and the pigeon-holes for sorting. The lighting by electricity of a telegraph-office such as that of North Brussels is a most difficult problem to solve. In fact, several conditions must be observed: all light hurtful to the eyes must be avoided, but at the same time all the different parts of the room in which the instruments are placed must be fully and uniformly lighted, and care must be taken that shadows shall not be thrown by the clerks upon the slips of the instruments and the telegram forms.

The best method with which we are acquainted of attaining this result, *i.e.*, the complete illumination of 1,000 square metres of surface, consists in employing large burners and in utilising the ceiling and the walls as reflectors, with a view to arriving at as complete a diffusion of light as possible. With this object the ceilings and the walls were whitewashed, the gray blinds of the windows were replaced by white ones, and the rays sent out from the lamps were directed upwards by a system of prismatic reflectors.

A combination of lenses and movable flat mirrors applied to the lamp of the little room enabled the adjacent office to be lighted. This method, which M. Jaspar had put into practice some time before (his patent for the employment of reflectors for the division of the electric light is dated September 27th, 1878) in his workshops at Liège and at the establishment of M. Dièze, manufacturer of artificial wool, at Pepinster, is not the least interesting item in our installation at North Brussels.

I. *The Installation.*

An Otto gas-engine of eight nominal horse-power and three "Gramme" dynamo-electric machines, workshop type, are placed in the basement of the northern station, and fixed by means of bolts and plates into strong brickwork. The transmission of the motion is effected by means of straps stretched horizontally. Three regulators of the Jaspar system are placed in the two instrument-rooms, on three tripods, varying in height at the positions indicated in fig. 1. The machines, which are at a distance of about sixty-five metres from the lamps, are connected with them by means of two cables, the core of which is formed of seven wires of tinned copper, each 0·11 millimetres in diameter, and the insulating material, three millimetres thick, consists of three layers of gutta-percha compounded together.

II. *Dynamometrical Trials of the Motor.*

The Otto engine, working two Gramme machines, performs regularly 160 revolutions per minute, and the number of explosions within that time is from forty to fifty. The machines make 934 revolutions per minute.

We found that for 160 revolutions and 44 explosions it was necessary to load the "Prony" break with $24^k, 15$; and for 160 revolutions and 50 explosions with $25^k, 15$. If we apply the formula of the break, we have in the first case :—

$$\frac{24^k, 15 \times 2\pi \times 0^m.925 \times 160}{60 \times 75} = 4{\cdot}988 \text{ horse-power}$$

and in the second case :—

$$\frac{25^k, 15 \times 2\pi \times 0^m.925 \times 160}{60 \times 75} = 5{\cdot}194 \text{ horse-power.}$$

$0^m.925$ is the length of the lever, which tends to raise the weight with which the break is loaded. We may conclude, therefore, that the two machines together absorb 5 horse-power of motive force, or 2½ horse-power each.

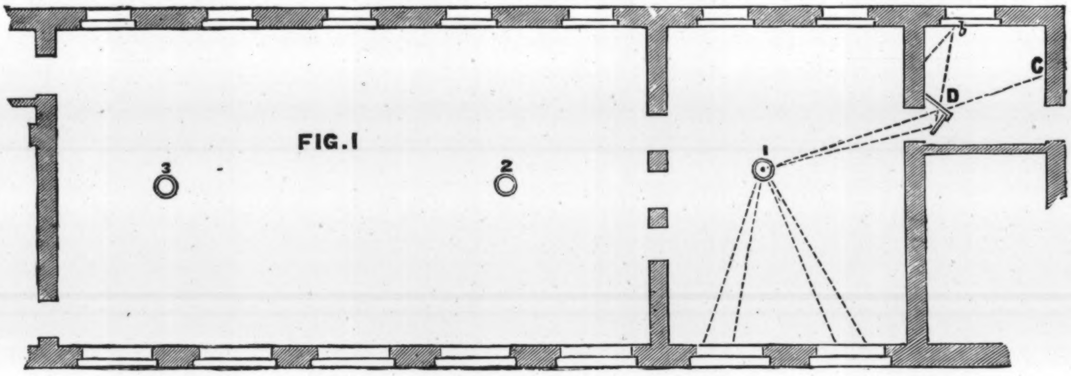


FIG. I

On calculating the effective force that can be supplied by the machine, we found that we required

for 160	revolutions	and	77	explosions	to	load the break	with $44_k, 32$
,, 158	,,	,,	77	,,	,,	,,	,, $44_k, 82$
,, 148	,,	,,	74	,,	,,	,,	,, $45^k, 32$
,, 160	,,	,,	79	,,	,,	,,	,, $45^k, 07$

and by applying the above formula we obtain

In the first case, 9·150 horse-power.

In the second case, 9·109 horse-power.

In the third case, the rate is no longer normal: the machine gives an explosion at each revolution.

In the fourth case we get 9·308 horse-power.

We may say, therefore, that the gas-engine is capable of performing work of $9_{\overline{3}}$ horse-power.

From this it follows that the three dynamo-electric machines consuming 7½ horse-power, 1⅚ are still available. Part of this force is employed in working a Schiele ventilator, which ventilates the space round about the motor.

III.—*Photometric Measurements.*

The measurements taken at different times of the luminous intensity of the regulators gave, on an average, with the Bunsen photometer, 835 candles.

The standard candle used is that called "de l'Etoile," six to the kilogramme, burning 10 gr. 8 of stearine per hour, with a flame 8 centimetres high.

The photometrical results were obtained by placing the electric arc and the flame of the candle on the same horizontal line.

The maximum luminous intensity is obtained, with continuous current machines, when a straight line leading from the photometer to the arc makes an angle of 50 to 60 degrees with a horizontal plane.

Not having at our disposal a room sufficiently high to make our experiments under these conditions, we confined ourselves to taking the mean of the intensities. The experiments of M. Hippolyte Fontaine have shown that this average intensity is clearly equal to double that obtained when the arc, the photometer, and the standard light are on the same horizontal line (see *Revue Industrielle*, 9th July, 1879). According to these data, the mean intensity of the light obtained in the Jaspar regulators, burning Siemens' carbons (the positive having a central core, and the negative being of retort carbon), is 1,670 candles, the gas-engine making 160 revolutions and the dynamo-electric machines 955 revolutions per minute.

IV.—*Electric Measurements.*

The length of the circuits, including return wire, connecting the three Gramme machines to the three Jaspar lamps, are respectively 90·5, 120·7, and 140 metres. In order to measure the resistance in ohms of these lengths and that of the coils of the machines, we used a Wheatstone's bridge. After the cooling of the machines we found—

Designation of the Circuits.	Conducting Wires.	Coils of Electro-magnets.	Gramme ring	Solenoid of the Regulator.
First	0·44	0·65	0·88	0·086
Second	0·48	0·66	0·88	0·086
Third	0·53	0·72	0·84	0·086

The resistance of the carbons employed is 0·152 ohms for 0·22 metres of Siemens' carbons, and 0·175 ohms for 0·13 metres of retort carbon. It follows from this that if there had been no other resistance than those already enumerated, the current would have to pass through in each circuit at the commencement of the lighting respective resistances of 1·723, 1·773, and 1·873 ohms.

Each of the circuits, not including the dynamo-electric machines and the lamps, offers an insulation resistance of 55 megohms per kilometre.

When the gas-engine makes 160 revolutions and the Gramme machines 930 revolutions per minute, the intensity of the current measured by Siemens' electro-dynamometer varies between 15 and 16·6 ampères. We found by the method of discharging a condenser that the difference of potential at the terminals of the lamps is approximately 51 volts, and that at the terminals of the Gramme machine 57 volts. If we apply Joule's formula to these results—

$$\text{T} = \frac{\text{I}^2\text{R}}{9{\cdot}81 \times 75} \text{ horse-power.}$$

Where $\text{I} = 15{\cdot}8$ ampères

and $\text{R} = 1{\cdot}8$ ohms

we find $$\text{T} = \frac{249{\cdot}64 \times 1{\cdot}8}{9{\cdot}81 \times 75} = \frac{449{\cdot}352}{735{\cdot}75} = 0{\cdot}61 \text{ horse-power,}$$

which gives us an available force of 24·4 per cent.

As it is to be supposed that there exists in the arc either an opposing electromotive force or a resistance the preceding formulæ should be modified as to the values to be given to R. This enables us to admit that the available force is greater than that which we obtain by calculation. We cannot, in fact, think that 75·6 per cent. of the effective work is absorbed by the motion of the machines and the heating of the wires.

V.—*Different Methods adopted for Lighting the Rooms at North Brussels.*

The first plan adopted for the lighting was to place three lamps on tripods at the points marked 1, 2, and 3, in fig. 1. In the three lamps, placed at a height of 2·75 metres, the positive carbon was underneath, so that the light was thrown on the ceiling and walls, partly directly, and partly by the help of a reflector, R (*see* figs. 2 and 2*a*). A cylinder, V, formed of sheets of glass, placed on the reflector, R, and a truncated cone of ground glass, G, obviated the projections of incandescent carbon. The globe, G, also prevented the light from striking directly on the eyes of those *employés* near the lamp.

By this method a light was obtained which was more than sufficient, but not very steady.

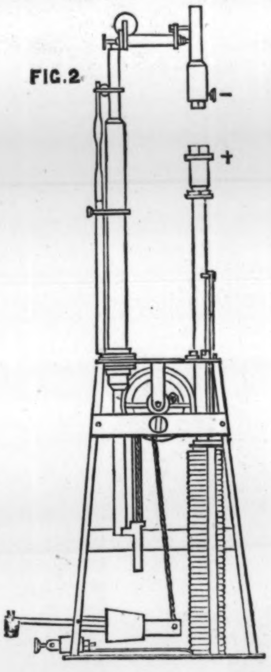


FIG. 2

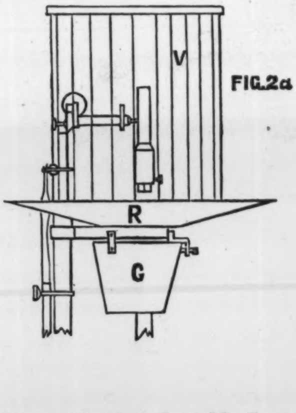


FIG. 2a

This want of steadiness arises from the reverse employment of the lamp: the hollow, which is formed at the extremity of the positive carbon placed underneath, becomes filled with impurities contained in the carbon; these substances, on becoming fused, produce variations in the intensity of the light. This method of lighting was continued until the 15th of February, 1880. At that date M. Jaspar modified the system by adopting a double reflection of the light. The positive carbon of the regulator was placed at the top of the lamp. (*See* figs. 3 and 4.) The light is reflected on the ceiling by horizontal mirrors, M, N, and M′N′, directed downwards. In order to hinder the full light from dazzling the operators, the luminous arc is enclosed in a truncated quadrangular pyramid, R, S, T, U, of sheet iron nickeled inside; the base of the pyramid is turned upwards. By this means we obtained a very steady light, although the quantity of light utilised is not so great, on account of the reflection on the mirrors, as that resulting from the first method, it is still more than sufficient for the *employés* who attend to the telegraphic instruments. By using lamp No. 1, which belongs to the first room, we were able to light the little sorting room, which leads to the two instrument rooms. With this object the regulator of the first room (*see* fig. 5) bears a crown of six lenses, on which rests a horizontal nickeled reflector. The rays of the cone formed by the lenses are normal to those of the crater of the positive carbon. This arrangement allows of luminous sheaves being sent out by means of plane mirrors in six different directions. One of these sheaves is intercepted by another plane mirror, D (*see* fig. 1), which directs it on to a white blind, *b*, from which the light is reflected on to the pigeon-holes.

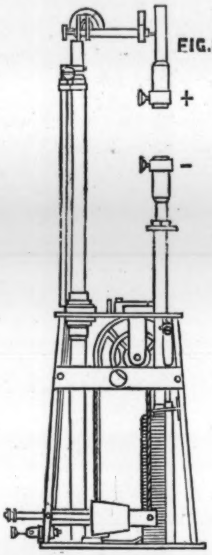


FIG.3

A second beam is directed to C, above the clerk who occupies the desk placed in this room. In order to prevent the luminous arc from dazzling the eyes it was enclosed in an elliptical truncated cone of sheet iron, nickeled inside. The luminous point occupies a focus of one of the horizontal sections.

VI.—*Experiments with different Carbons for Regulators.*

We tried the principal carbons known: the gas carbons, Carré's, Gauduin's, Siemens' coppered carbons, and those with central core, of Siemens Brothers, of different diameters. The majority of the artificial carbons gave bad results, the light changing frequently in intensity and colour. The best results were obtained with the gas carbons prepared with borax, and those of Siemens Brothers, with central core of plumbago, either used singly, or together with different diameters. The most advantageous combinations are the following:—

I. Two 9-millimetre square gas carbons.

II. Two square gas carbons, one of which, forming the positive pole, is 11 millimetres, and the other 9 millimetres.

III. A round carbon of Siemens Brothers, 14 millimetres in diameter, forming the positive pole, and a 9-millimetre square gas carbon, for the other pole. With a length of 22 centimetres for the carbon, which becomes hollowed out, and of 13 centimetres for the other (35 centimetres altogether), the first combination allows of an illumination of 3½ hours, and the two other combinations of 4½ hours.

VII.—*Attention required by the Apparatus.*

The daily attention required by the gas-engine is the same as that necessary for all motors of the same kind.

The Gramme Machines.

The precautions to be taken in regard to these machines can be summed up as follows:—

1. The brushes should never be loosened while the current is established, because the spark which would be produced at the moment of their separation from the commutator, would burn the copper wires, of which they are composed.

2. The brushes should be moderately light, so that the pieces of bronze which support them may not rub against the commutator and wear it out. The wires of the brushes alone should rest upon it.

3. The position of the brushes being of great importance, it should be examined, and noted down at the time of the arrival of the machines, so that if shifted it may be re-established.

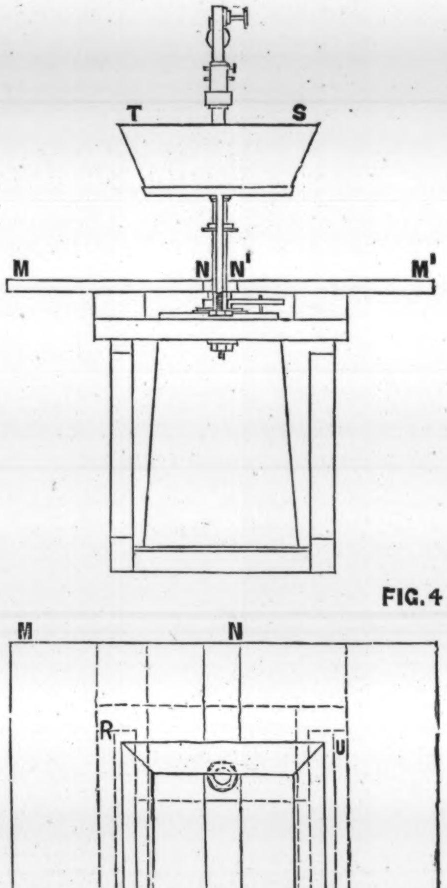


FIG. 4

4. If, by accident, the ends of the brushes should be burnt, the melted part should be cut off neatly, the brush should be pushed forward, so as to restore it to its original length, and then the ends should be filed, or sharpened so as to give them their former shape. Very few sparks should be produced at the point where the brush rubs against the commutator. Large sparks would indicate that the brushes are either badly placed, or not in good condition.

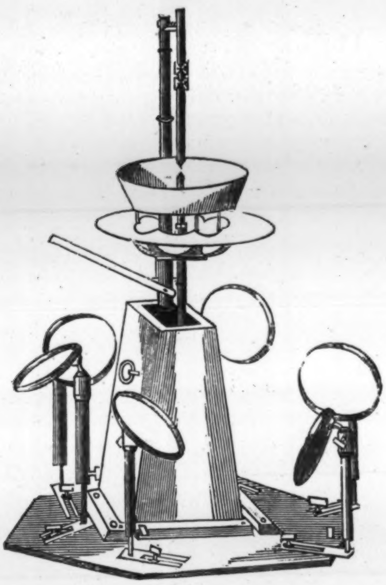
5. In order to avoid the wearing out of the brushes, it is advisable, now and then, to grease the commutator with a little oil on a rag, but care must be taken that the quantity of oil used is not sufficient to clog the brushes or to increase appreciably the electrical resistance of the circuit.

6. The driving-band should be kept tightly stretched.

7. All the machines should be in order before being put in motion. It may be ascertained whether the current is established by bringing a piece of iron near the ring at the top of the inductor; if it is attracted the current is circulating.

8. It is indispensable that the speed of the motor should be very regular; the bobbin of the Gramme machine should perform 900 to 1,200 revolutions per minute. If, after running about an hour, the dynamo-electric machine should become heated beyond 100 degrees Centigrade, the speed must be lessened; if, on the contrary, the temperature does not exceed twenty or thirty degrees Centigrade, the speed must be increased.

FIG 5



The heating depends on the greater or less resistance of the wire connecting the machine with the lamp. The longer the wire is and the less its diameter the more its resistance increases, and, consequently, the more must the speed of the machine be increased.

9. The screws which fix the bobbin to the axle should be examined from time to time to see whether they have become loosened.

The Jaspar Lamp.

Fig. 3 gives an illustration of the Jaspar lamp. The lower carbon-holder is in electrical communication with the frame of the apparatus, and the other is completely insulated from it. The two carbon-holders are each guided by a vertical rod, which is fitted into a cylinder filled with mercury. Two cords, connnected by two pullies, the diameter of one being double that of the other, to the two rods supporting the carbons, regulate the distance between them, so that the distance traversed by the positive carbon is almost double that passed through by the negative carbon. A weight, which slides along a horizontal bar, is connected by a cord to a third pulley, fixed upon the axle of the two first.

The extremity of the rod of the lower carbon-holder, which is of soft iron, passes into a solenoid, which, by the magnetic attraction resulting from the passage of the current through its spirals, maintains a distance of three millimetres between the points of the carbons. When this distance is increased the intensity of the current is diminished, and the carbons come closer together. The object of the weight, which acts in an opposite direction to the electric current, is to enable the regulator to be employed for currents of very different intensities. The mercury in the two cylinders, in which are fixed the rods guiding the carbon-holders, prevents the sudden bringing together of the carbons, and insures good contact between the lower rod and the frame of the apparatus.

The lower part of the regulator is protected from the dust and from shocks by an envelope of varnished sheet-iron fixed to the woodwork of the apparatus by two screw-hoops, serving as handles for carrying about. The precautions to be taken in the manipulation of these regulators are as follows:—

I. Before starting them the rings should be unscrewed, the sheet-iron envelope taken off, raising it very carefully upwards, and 300 grammes of very pure mercury should be poured into the cylinders, taking care to move slowly the rod bearing the piston, in order to expel the air contained under it.

II. To make sure, before putting back the envelope, that the cords have not slipped from the grooves of the pulleys, and that the movable parts work quite freely. If everything is in order, and if the carbon-holders are drawn away from each other by pushing down the lower carbon, the two carbons should come slowly together, without jerk or break, as far as they can go.

III. The weight being drawn to the middle of the rod which bears it, the lamp is in readiness for the Gramme machine, revolving at 900 turns. The distance between the carbons during the action of the regulator is then 3 mm.

IV. To insure before lighting that no mercury has gone out of the cylinders, to work by hand the mechanism, and, if the movement of the carbon-holder is not regular, to clean the cylinder and its piston and filter the mercury through flannel.

V. To keep clean the rods of the carbon-holders by wiping them with a dry linen cloth, and if the apparatus has become clogged, to take it all to pieces and thoroughly clean the rubbing surfaces.

VI. In case the cords should break, to replace them by new ones, taking into consideration their respective lengths between the knots. These lengths are as follows:

For the large wheel	...	...	0^{m}. 260
The next size	...	...	0^{m}. 185
For the small wheel	...	...	0^{m}. 240

VIII. The comparative cost of the lighting by gas and the lighting by electricity which have been used successively at the office of North Brussels.

A.—*Labour and Consumption of Material.*

Before the employment of the electric light, the large instrument-room was lighted by 47 gas-jets, the smaller one by 21, and the room leading into them by 2—or, altogether, 70 jets—each consuming 140 litres per hour. The total consumption was, therefore, 9^{m3}. 800 per hour.

This being at the rate of 0.15 fr. the cubic metre, the expense amounted to 1.47 fr. per hour for the complete lighting of the three rooms. To this price we must add 0.15 fr. for the glass chimneys and smoke-consumers, which brings it up to 1.62 fr.

In working the three Gramme machines, the gas-engine consumes about 8 cubic metres of gas per hour, which costs 0.15 fr. × 8 = 1.20 fr.

The lubricating of the Otto motor take half a litre of oil per day. The management of the machine and lamps is intrusted to one man, who receives a monthly salary of 120 frs., or 4 frs. per day.

The arrangement of the wires and telegraph instruments at the office of North Brussels necessitates the burning of gas all through the night. After 9.30 p.m. only a few of the instruments are used for the transmission and reception of despatches; at 11 o'clock, when the night service commences, this number is still less. The instruments at work after that time are scattered in various parts of the two rooms. The operators then require for their work a limited amount of light, easily obtained by lighting a few gas-jets.

As on the shortest days six hours of electric lighting are required (from 3.30 to 9.30 p.m.) and on the longest two hours (from 7.30 to 9.30 p.m.), we have on an average a duration of four hours. It is upon this average that we calculate the cost of the three lamps.

The total length of the carbons used with the Jaspar regulator does not exceed 0^{m}. 35, 0^{m}. 22 for the positive carbon, and 0^{m}. 13 for the negative.

By burning gas carbons 9 millimetres square, or gas carbons 11 millimetres square for the positive pole and

9 milimetres for the negative, or else Siemens Brothers' round artificial carbons with central core, 14 millimetres in diameter for the positive pole, and gas carbons 9 milimetres square for the negative, we arrive at the following results :—

In one lamp we burn, in $3\frac{1}{2}$ hours, 0^m. 35 of gas carbon 9 millimetres square; in $4\frac{1}{2}$ hours 0^m. 22 of gas carbon 11 millimetres square and 0^m. 13 of gas carbon 9 millimetres square ; in $4\frac{1}{2}$ hours 0^m. 22 of Siemens Brothers' round carbons, 14 millimetres in diameter, and 0^m. 13 of gas carbon 9 millimetres square.

If we bring this rate of consumption to an average duration of 4 hours, we find that we burn :

I. 0^m. 40 of carbon, 9 millimetres square.

II. 0^m. 20 of gas carbon 11 millimetres square, and 0^m. 12, 9 millimetres square.

III. 0^m. 20 of Siemens Brothers' carbons, 14 millimetres in diameter, and 0^m. 12 of gas carbon, 9 millimetres square. From these data, it follows that the cost of labour and consumption of material in producing the electric light by means of three Jaspar lamps, for 4 hours, can be estimated as follows :

	Frs.
Carbon...	2.24
32 cubic metres of gas at 0.15 fr.	4.80
½ litre of oil, rags, &c.	0.75
Salary of workman	4.00
Total ...	11.79

Or 2.95 frs. per hour.

We have already found that the cost of consumption with lighting by gas amounts to 1.62 fr. per hour.

B.—*Cost of the two Methods of Lighting.*

The cost of a complete installation of gas-pipes, meter, &c., such as that used at the office of North Brussels, may be estimated at 50 frs. per burner. The seventy burners used in three instrument-rooms cost, therefore, for installation, 70 × 50, or 3 500 frs.

For lighting by the electric light we have, for the cost of installation :—

	Frs.
3 Gramme machines, workshop type	4,500
3 Jaspar regulators	840
3 tripods of variable height	74
3 commutators	81
350 metres of insulated wires and cable	350
Accessories for the regulators	300
An eight-horse gas-engine	5,970
Fixing of the motor and instruction of workman ...	650
Total ...	12,765

Calculating the interest and repairing in the proportion of 10 per cent., we get, in the two cases :—

a. For gas : 0.96 fr. per day, or 0.24 fr. per hour of lighting.

b. For the electric light : 3.49 fr. per day, or 0.87 fr. per hour of lighting.

The actual cost of lighting per hour amounts, therefore :—

I. For gas : to 1.86 fr.

II. For the electric light : to 3.82 frs.

Thus, the electric light costs 2·05 times as much as gas.

If we take into account the luminous intensity, we find that one candle-power per hour of gas costs 0.0035 fr. (one gas-jet being equal to $7\frac{1}{2}$ candles), and one candle-power per hour of electric light costs 0.00076 fr. ; *i.e.*, 4 6 times less than gas.

IX.—*Concluding remarks.*

In rooms like those in which the telegraph instruments are placed at North Brussels, where the ceiling is low and the number of *employés* somewhat numerous, the use of gas for lighting seriously affects the health of the occupants. Gas vitiates the air by transforming part of the oxygen into carbonic acid, and also by heating it excessively.

The electric light presents none of these inconveniences : very little oxygen is absorbed, and the temperature is not appreciably raised. The work is performed about as easily as by daylight, the reading of the slips is rendered easier, and the operators are not so fatigued, all of which is very advantageous for the regularity and celerity of the service.

We give an extract from a letter addressed to the Administration by M. le Percepteur of North Brussels, January 12th, 1880 :—

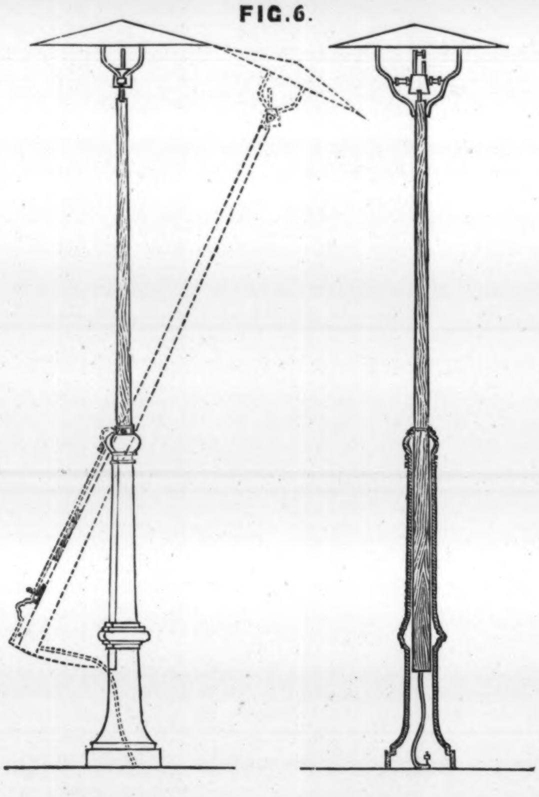
> Thanks to the light produced, which is almost equal to daylight, the work is performed with less fatigue than by gas-light, and the operators who, during the winter, pass seven hours after dark at the office, find themselves much fresher after their work than usual. The temperature of the room is no longer that of a furnace, as was formerly the case. We have received no complaint about the adoption of the electric light from any of the *employés*, and it is a great disappointment to them when it cannot be employed.

X.—*The Lighting of a Public Place.*

The success of the electric light at the Telegraph Office at North Brussels decided the Administration of Railways to attempt, in co-operation with the parochial authorities of Saint-Josse-ten-Noode, a trial of lighting, opposite the principal entrance of the Northern Railway station.

For this purpose a gas-engine of eight horse-power was installed to work three Jaspar regulators, destined to light the space opposite the station. The three lamps were placed at a height of about 9 metres, one in the middle of the *façade* of the station, on the building itself; the two others in the Place des Nations, so that the light should be shed equally over the space to be lighted.

FIG. 6.



Each lamp is surmounted by a reflector of whitened sheet-iron, of conical shape. Behind the regulator, placed on the station, is a reflector composed of two plane mirrors, which send the light towards the centre of the space. The three burners are enclosed in globes of alabaster glass, which diffuse the light around.

The two regulators in front of the station are placed on candelabra, shown at fig. 6. A bracket, to the extremity of which the lamp is suspended, turns on an axle, and thus enables the carbons to be renewed. The two parts of the bracket are equalised so as to be easily managed. The plinths of the candelabra are of cast-iron.

The lamp has a divided axle, the two ends of which are inserted into pivots fixed to the candelabrum, and thus it can swing during the descent of the bracket.

The three Jaspar regulators are advantageously substituted in lighting the Place des Nations and the approaches to it for 20 ordinary gas-lamps, consuming 200 litres per hour, and two Sugg burners, consuming 1,400 litres per hour.

The cost of the two methods of lighting can be estimated as follows :—

INSTALLATION.

I.—Of the electric light.

	Frs.
3 Gramme machines, workshop type	4,500
3 Jaspar regulators	840
3 commutators	60
Wires and underground cable	550
2 candelabra	320
Accessories for the lamp on the building	100
An 8 horse-power gas-engine	5,970
Total ...	12,340

II.—Of gas.

	Frs.
20 Ordinary gas lamps, with burner	3,000
2 ,, ,, with Sugg burner... ...	1,200
Total ...	4,200

The cost of labour and consumption of material, supposing the duration of lighting to be six hours per day, amounts to :—

	Frs.
Carbons for regulator	3.36
48 cubic metres of gas at 0·15 fr.	7.20
Oil, rags, &c.	0.75
Salary of workman	4.00
Total ...	15.31

or 2·25 frs. per hour.

The cost of consumption of material with lighting by gas amounts to 1·02 fr. per hour.

The cost per hour is, therefore, as follows :—

I.—Electric light.

	Frs.
Interest and repairing of installation, at 10 per cent.	0.56
Labour and consumption of material	2.55
Total ...	3.11

II.—Gas.

	Frs.
Interest and repairing of installation, at 10 per cent.	0.19
Gas consumed	1.02
Total ...	1.21

Under these conditions, the price of lighting by gas is 2·57 times less than that of lighting by electricity. If we calculate, as before in the lighting of the office, the cost per candle-power per hour, we should find that the electric light is much more economical than gas.

FIRE RISKS FROM ELECTRIC LIGHTING.

RULES and regulations for the prevention of fire risks arising from electric lighting, recommended by the Council of the Society of Telegraph Engineers and of Electricians in accordance with the report of the committee appointed by them on May 11, 1882, to consider the subject.

Members of the committee.—Professor W. G. Adams, F.R.S., vice-president; Sir Charles T. Bright; T. Russell Crampton; R. E. Crompton; W. Crookes, F.R.S.; Warren De la Rue, D.C.L., F.R.S.; Professor G. C. Foster, F.R.S., past president; Edward Graves; J. E. H. Gordon; Dr. J. Hopkinson, F.R.S.; Professor D. E. Hughes, F.R.S., vice-president; W. H. Preece, F.R.S., past president; Alexander Siemens; C. E. Spagnoletti, vice-president; James N. Shoolbred; Augustus Stroh; Sir William Thomson, F.R.S., past president; Lieut.-Colonel C. E. Webber, R.E., president.

These rules and regulations are drawn up not only for the guidance and instruction of those who have electric lighting apparatus installed on their premises, but for the reduction to a minimum of those risks of fire which are inherent to every system of artificial illumination.

The chief dangers of every new application of electricity arise mainly from ignorance and inexperience on the part of those who supply and fit up the requisite plant.

The difficulties that beset the electrical engineer are chiefly internal and invisible, and they can only be effectually guarded against by "testing" or probing with electric currents. They depend chiefly on leakage, undue resistance in the conductor, and bad joints, which lead to waste of energy and the production of heat. These defects can only be detected by measuring, by means of special apparatus, the currents that are, either ordinarily or for the purpose of testing, passed through the circuit. Bare or exposed conductors should always be within visual inspection, since the accidental falling on to, or the thoughtless placing of other conducting bodies upon, such conductors might lead to "short circuiting" or the sudden generation of heat due to a powerful current of electricity in conductors too small to carry it.

It cannot be too strongly urged that amongst the chief enemies to be guarded against are the presence of moisture and the use of "earth" as part of the circuit. Moisture leads to loss of current and to the destruction of the conductor by electrolytic corrosion, and the injudicious use of "earth" as a part of the circuit tends to magnify every other source of difficulty and danger.

The chief element of safety is the employment of skilled and experienced electricians to supervise the work.

I. THE DYNAMO MACHINE.

1. The dynamo machine should be fixed in a dry place.
2. It should not be exposed to dust or flyings.
3. It should be kept perfectly clean and its bearings well oiled.
4. The insulation of its coils and conductors should be perfect.
5. It is better, when practicable, to fix it on an insulating bed.
6. All conductors in the dynamo room should be firmly supported, well insulated, conveniently arranged for inspection, and marked or numbered.

II. THE WIRES.

7. Every switch or commutator used for turning the current on or off should be constructed so that when it is moved and left to itself it cannot permit of a permanent arc or of heating, and its stand should be made of slate, stoneware, or some other incombustible substance.

8. There should be in connection with the main circuit a safety fuse constructed of easily fusible metal which would be melted if the current attain any undue magnitude, and would thus cause the circuit to be broken.

9. Every part of the circuit should be so determined, that the gauge of wire to be used is properly proportioned to the currents it will have to carry, and changes of circuit, from a larger to a smaller conductor, should be sufficiently protected with suitable safety fuses so that no portion of the conductor should ever be allowed to attain a temperature exceeding 150° F.

N.B.—These fuses are of the very essence of safety. They should always be enclosed in incombustible cases. Even if wires become perceptibly warmed by the ordinary current, it is a proof that they are too small for the work they have to do, and that they ought to be replaced by larger wires.

10. Under ordinary circumstances, complete metallic circuits should be used, and the employment of gas or water pipes as conductors, for the purpose of completing the circuit, should in no case be allowed.

11. Where bare wire out of doors rests on insulating supports, it should be coated with insulating material, such as india-rubber tape or tube, for at least two feet on each side of the support.

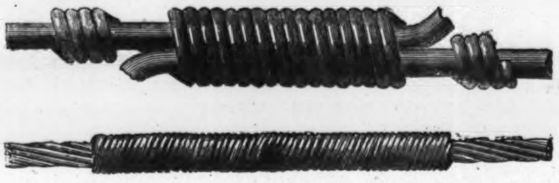
12. Bare wires passing over the tops of houses should never be less than seven feet clear of any part of the roof, and they should invariably be high enough, when crossing thoroughfares, to allow fire escapes to pass under them.

13. It is most essential that the joints should be electrically and mechanically perfect. One of the best joints is that shown in the annexed sketches. The joint is whipped around with small wire, and the whole mechanically united by solder.

14. The position of wires when underground should be efficiently indicated, and they should be laid down so as to be easily inspected and repaired.

15. All wires used for indoor purposes should be efficiently insulated.

16. When these wires pass through roofs, floors, walls, or partitions, or where they cross or are liable to touch metallic masses like iron girders or pipes, they should be thoroughly protected from abrasion with each other or with the metallic masses, by suitable additional covering; and where they are liable to abrasion from any cause or to the depredations of rats or mice, they should be efficiently encased in some hard material.



17. Where wires are put out of sight, as beneath flooring, they should be thoroughly protected from mechanical injury, and their position should be indicated.

N.B.—The value of frequently testing the wires cannot be too strongly urged. It is an operation, skill in which is easily acquired and applied. The escape of electricity cannot be detected by the sense of smell, as can gas, but it can be detected by apparatus far more certain and delicate. Leakage not only means waste, but in the presence of moisture it means destruction of the conductor and its insulating covering, by electric action.

III. LAMPS.

18. Arc lamps should always be guarded by proper lanterns, to prevent danger from falling incandescent pieces of carbon, and from ascending sparks. Their globes should be protected with wire netting.

19. The lanterns, and all parts which are to be handled, should be insulated from the circuit.

IV. DANGER TO PERSON.

20. To secure persons from danger inside buildings, it is essential so to arrange the conductors and fittings, that no one can be exposed to the shocks of alternating currents exceeding 60 volts; and that there should never be a difference of potential of more than 200 volts between any two points in the same room.

21. If the difference of potential within any house exceeds 200 volts, whether the source of electricity be external or internal, the house should be provided outside with a "switch," so arranged that the supply of electricity can be at once cut off.

By order of the Council,
F. H. WEBB, *Secretary.*

THE BAUDOT TELEGRAPH.

(*Sixth Article.*)

COMBINER (*continued*).—We shall now describe the combiner according to the practical form which it takes in M. Baudot's last models.

Fig. 7 shows the plan. We see ten concentric rings, representing the five pairs of grooves (normal and complementary), distinguished one from another by different signs. The shaded parts correspond to the projections and the white to the hollows. It must be borne in mind that an immense number of similar tables could be compiled, since, with the five effects necessary to form a signal, we obtain for our computation the product $1 \times 2 \times 3 \times 4 \ldots\ldots \times 29 \times 30 \times 31$. We will confine ourselves to the table chosen by the inventor.

In this table the projections and hollows do not occupy the entire circumference. A sector, equal to $\frac{13}{75}$ths, is reserved for the insertion of fixed stops, placed on the complementary grooves or those in action, and represented in black on the diagram. These stops serve for the pointing. The needles occupy $\frac{5}{75}$ths in this sector. When at rest the needles close the groove of action, and the rubbers then follow the grooves of rest; the frame does not fall, and no impression is made. The two grooves of each rubber are separated by a partition which prevents it from passing into the groove of action before having been directed there by the needle. There is no partition in the sector reserved for the pointing; the change of direction can be effected at this part only. The two grooves of one rubber are separated from the next by a partition extending all round the circumference. Besides the ten rings represented in fig. 7, we see an eleventh which encloses the others. It is equally divided into projections and hollows. These divisions are distributed in such a manner that the hollows always project over the spaces in the first groove of action. An examination of the figure will clearly show the advantage of this arrangement. The movement of the chariot bearing the five normal runners being determined in the three pairs of grooves according to the pointing, if the chariot has a sixth runner specially designed for this supplementary eleventh groove, the result will be that the fall of the frame brought about by the formation of the combination (say, five hollows) will only take place when the rubber itself corresponds to a space. We thus do away with one cause of deterioration which would otherwise lead to the rapid wearing out of the grooves of the table and of the collectors every time a change is made from a hollow to a projection after the production of a combination. The transfer is made only on one ring and one collector.

Fig. 8 shows the details of the combiner, and the arrangement of the hollows and projections corresponding to the letters of the alphabet. Above this is shown the system of the five rubbers (the sixth, before mentioned, is omitted, as it has no connection with the pointing). The five rubbers are fixed vertically and movable on a pivot horizontally. They support a frame which is constantly drawn down by a spring, *v*.

If the explanations already given are referred to, it will be seen how the displacement of a rubber is equivalent to the substitutions we had imagined in order to explain the formation of the combinations. The needle being actuated will close the entrance of the groove of rest, and direct the rubber into the groove of action. If the first needle is displaced in the forward movement of the frame, the first rubber will follow the groove of action, and the four others will remain in their respective grooves of rest; at the first division, a space coming under each of the five rubbers simultaneously, the frame will fall.

With the displacement of the second needle, the fall of the frame will take place at the second division, and so on for each of the combinations. The function of the frame is, in short, that of a collector seeking the place where it is to fall, a point always determined by the combination corresponding to the letter to be printed.

We will now consider the mechanism of the pointing. In the first brief description we said that the five keys of the manipulator at the post of arrival corresponded to the five electro-magnets, the armatures of which repeated the combination formed by the keys. We see, therefore, how the movement of these armatures can be utilised for affecting the action of the needles. In reality the line current does not act directly on the electro-magnets; it puts in motion relay which works them by a local current. The description of the relay employed by M. Baudot will be given subsequently; we shall first explain how the movement of the armatures of the pointing electro-magnets is transmitted to the needles.

The five electro-magnets are fixed against a plate in the apparatus. At the moment when the local current passes into an electro-magnet the armature is attracted, and, pressing against one extremity of the rod, *t* (fig. 9), enables it to push the appendage, *a*, of the lever of the needle. An index, *i*, of thin sheet-iron, fixed on the screw, *v*, of the armature and outside the plate, enables the movement of the armature to be controlled.

When the pointing electro-magnet is no longer influenced, the armature is brought back to rest by the rod actuated by the spring, *v*. The needle is maintained in the position in which it has been placed by means of a roller fixed to a

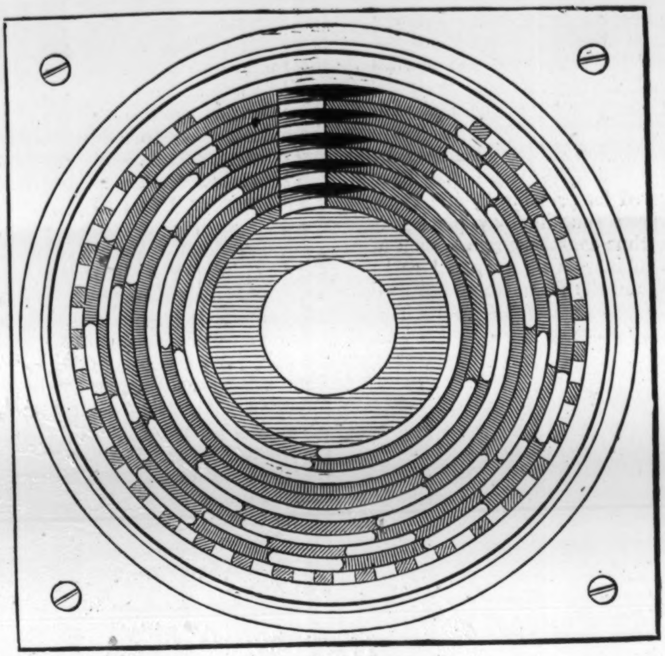
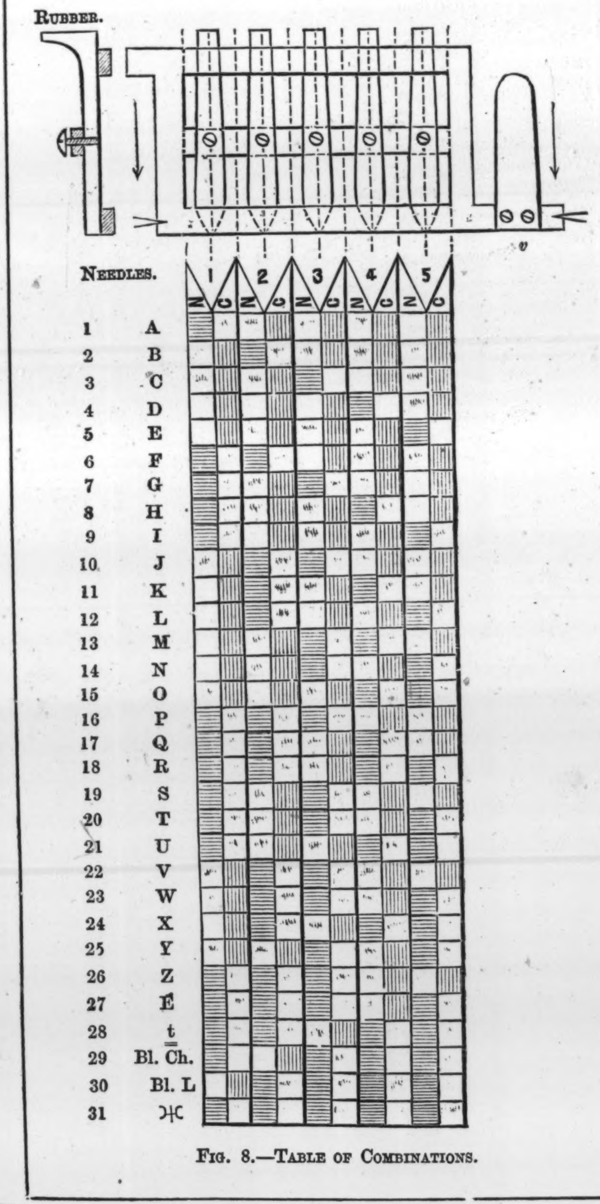


Fig. 7.—Combiner.



Needles.		1 N	1 C	2 N	2 C	3 N	3 C	4 N	4 C	5 N	5 C
1	A	▤			▥		▥		▥		▥
2	B		▥	▤			▥		▥		▥
3	C		▥		▥	▤			▥		▥
4	D		▥		▥		▥	▤			▥
5	E		▥		▥		▥		▥	▤	
6	F	▤		▤			▥		▥		▥
7	G	▤			▥	▤			▥		▥
8	H	▤			▥		▥	▤			▥
9	I	▤			▥		▥		▥	▤	
10	J		▥	▤		▤			▥		▥
11	K		▥	▤			▥	▤			▥
12	L		▥	▤			▥		▥	▤	
13	M		▥		▥	▤		▤			▥
14	N		▥		▥	▤			▥	▤	
15	O		▥		▥		▥	▤		▤	
16	P	▤		▤		▤			▥		▥
17	Q	▤		▤			▥	▤			▥
18	R	▤		▤			▥	▤		▤	
19	S	▤			▥	▤			▥		▥
20	T	▤			▥	▤			▥	▤	
21	U	▤			▥		▥	▤		▤	
22	V		▥	▤		▤			▥		▥
23	W		▥	▤		▤			▥	▤	
24	X		▥	▤			▥	▤		▤	
25	Y		▥		▥	▤			▥	▤	
26	Z	▤		▤		▤			▥		▥
27	É	▤		▤		▤			▥	▤	
28	$\underline{\underline{t}}$	▤		▤			▥	▤		▤	
29	Bl. C̄h.	▤			▥	▤		▤		▤	
30	Bl. L		▥	▤		▤		▤		▤	
31	ℋ	▤		▤		▤		▤		▤	

Fig. 8.—Table of Combinations.

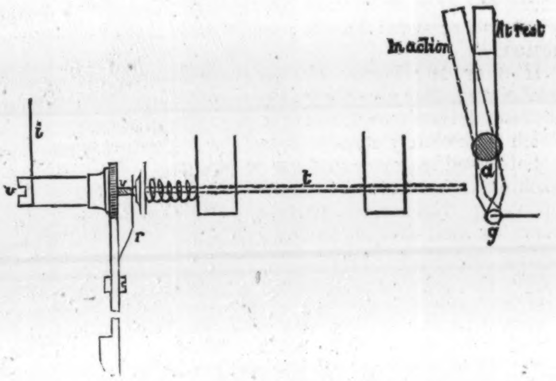


Fig. 9.—Detail of Needle Mechanism.

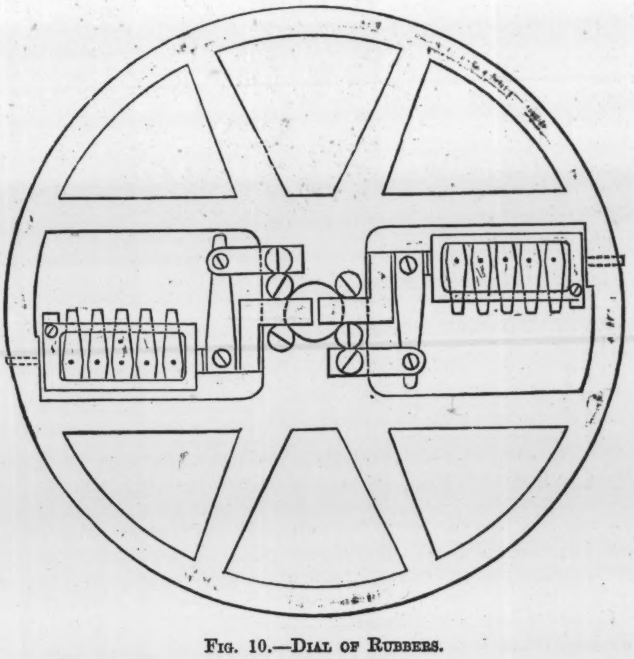


Fig. 10.—Dial of Rubbers.

spring-plate. As soon as the needles have passed through the frame of the rubbers a cam fixed on the axle of the combiner pushes a rack into which the levers of the needles pass, and thus brings them back all together into the positions of rest, so as to allow of the printing of the next combination.

We shall conclude this description of the combiner by giving an illustration of the dial (fig. 10). We have shown that this instrument served for printing by one type-wheel only. The process has been simplified by placing at each receiver two type-wheels, thus constituting a system of double transmission. The combiner is so arranged as to present two symmetrical parts, and the frame then has two collectors.

(*To be continued.*)

ON THE REACTION-CURRENT OF THE ELECTRIC ARC.

By MM. JAMIN and G. MANEUVRIER.

THE two currents in alternately contrary directions given by Gramme's self-exciting machine are absolutely equal. Consequently they do not decompose water, and a tangent-galvanometer inserted in the circuit experiences no deviation, since the opposite effects which succeed each other at very short intervals annul each other.

This destruction of effect is kept up if we place in the circuit one or more burners, provided that the carbon points are equal, arranged in the same manner, and are equally heated.

If 8 or 10 Bunsen elements are introduced into the total circuit, they give the galvanometer when the machine is at rest a deviation $= \delta$, and if it is at work a deviation $= \delta'$, which is absolutely equal to δ.

This equality proves that the resistance of the wires of the machine to a current coming from an exterior source does not change whether the machine is at rest or in motion; it shows, further, that the two effects of the machine and the battery are superimposed and are independent of each other.

If we withdraw the battery and ignite in the circuit a burner formed of two unequal carbons, the one thick (0·004 m.) and the other more slender (0·002 m.), this inequality is sufficient to determine a permanent deflection of the needle as if a battery had been introduced. The two systems of inverse currents given by the machine cease to be equal: that which passes from the thicker to the more slender carbon, from that which is least heated to that which is most, predominates over the system in the opposite direction. There results a differential current which is indicated by the galvanometer, and which is the more powerful as the difference of thickness of the two carbons is greater. It reaches its maximum between a large mass of coke which is slightly heated and a pencil terminating in a fine point, which attains the highest temperature. The same phenomenon occurs and in the same direction if we produce an arc between a mass of any metal and a point of coke. As it is difficult to maintain the arc constant, the intensity of the differential current is very variable, and the following results can only be considered as a first approximation:—Lead, 29°; iron, 30°; coke, 31°; copper, 60°; mercury, 70°.

In general the differential current is feeble or null when the arc is of small extent, and increases with the difference of the electrodes. With zinc it is at first as intense as with copper; but it decreases suddenly, probably by reason of the oxide with which the metal is soon covered.

This deviation depends on two things—1st, the mean electromotive force; 2nd, the resistance introduced into the current by the arc formed. The author has compared this force and this resistance in different cases. For the force he has made use of nine Bunsen elements, new and well amalgamated. The experiment, not susceptible of great precision by reason of the fluctuation of the arc, gave the following values for the electromotive force of the differential current, estimated in Bunsen elements:—Lead, 2·5; iron, 3·2; coke, 5·0; copper, 50·6; zinc, 66·2 to 5·7 mercury, 103·7.

The three first mentioned substances are nearly equal, and the three latter are very active. Zinc has the force of 66 at the outset, which soon falls to 5. Mercury offers a constant and enormous force.

The resistances are: Coke, 0·406; iron, 0·307; lead, 0·283; copper, 1·41; mercury, 0·89; zinc, 1·02, falling to 0·56.

The differential current can only be explained in two ways—either by a difference in the resistance or by an inequality in the inverse reactions of the arc in one or the other direction.

To know if the resistance of the arc varies with the direction, the authors passed a continuous current at first from the coke to the mercury, and then in the opposite direction. A galvanometer measured the intensity in the two cases, but no appreciable difference was detected. These experiences presented a remarkable feature. When the current passed from the mercury to the coke the arc had a very decided green colour and the metal was volatilised briskly; in the contrary case the arc was reddish and the production of vapour was less abundant, which renders manifest the inequality existing in the two cases. But if we direct through the burner the alternating currents of the Gramme machine the arc is green, proving that there is a predominance of the current from the mercury to the coke as compared with that in the opposite direction; and since there is no difference in the resistance of the arc the cause of the differential current must be sought in an especial property of the alternating currents.

Each of these two systems of currents stores up at the moment when it begins a certain sum of energy which becomes free when it ceases and is transformed into an inverse electromotive force. Thus a first current ⟶, at first very feeble, increases little by little, and, when it ceases, gives rise to an inverse reaction, ⟵, which is added to the current, ⟵, which the machine produces at the same moment. If, therefore, one of the systems of currents, ⟶, offers a weaker reaction than the contrary system, ⟵, it will be less enfeebled and more reinforced, and will determine the direction of the differential current.

Whatever may be the explanation of these facts, it is clear that when once produced by an arc with mercury the differential current changes entirely the play of the machine; one of the systems of currents, if not extinguished, is much weakened, whilst the other system is constituted by successive currents of greater intensity and duration. Also every electric arc introduced in addition offers the same aspect as that of the battery—that is to say, greater lustre and heat at the positive pole, with transfer of matter to the negative pole. The machine, which previously was unable to decompose water, becomes able to effect this like a battery with an electromotive force equal to 100 Bunsen elements. It can also, like a battery, effect all chemical reactions desired, magnetise soft iron, reduce metals, transmit power, and, in a word, becomes a substitute for a machine with continuous currents.

There are two types of magneto-electric machines. Some, derived from the Gramme system, can give directly currents of a constant direction. Others, like that of Nollet or of Méritens, can only yield alternating currents, and are applicable only to the production of light. Vain attempts have been made to adapt them for chemical work by altering the currents with a commutator.—*Comptes Rendus.*

THE ATLANTIC CABLE COMPANIES.—Before the last joint purse arrangement was well completed, we had reason to believe that in a very short space of time another competition for the Atlantic traffic would be in the field. It has recently been stated in New York and London that two new cables are soon to be put down, and the India-rubber Gutta-percha and Telegraph Works Company are mentioned as the probable contractors for the making and laying thereof. There is some authority for these statements, but, as yet, we are not aware that any definite contract has been made.

THE TELEGRAPH ENGINEERS' SOCIETY AND THE ELECTRIC LIGHT.

WE cannot congratulate the members of the committee, appointed by the Society of Telegraph Engineers and of Electricians to investigate the fire risks attached to the employment of the electric light, in having produced a report which can in any way be considered superior to that brought forward some time since by Mr. Heaphy, C.E., for the guidance of the Phœnix Fire Office. As a matter of fact, this gentleman's single-handed production deals more exhaustively with the entire subject than does the meagre amount of matter collected by the committee of the Telegraph Engineers' Society. We cannot think that the majority of the gentlemen named had any hand whatever in framing this report, or the result would have been more worthy of their reputation. We would undertake to say that, had Professors Ayrton and Perry been commissioned to draw up a report on this important subject, we should have had, at least, something material added to our present knowledge, and many valuable suggestions, which would not probably occur to those whose minds and time are actively engaged in daily practical work, would have been brought forward.

One would naturally have expected, not necessarily a voluminous amount of matter from this committee, but at least sufficient information, embodied into the form of rules, as to be looked upon in the light of an authoritative and exhaustive treatise. Instead of this, we are treated to a mild and condensed account of what we should imagine everybody had read before. The six rules relating to the dynamo machine contain absolutely nothing but what every electrical engineer would do his best to arrange for. The information relating to the wires is not nearly so thoroughly treated as by Mr. Heaphy in the report above referred to; and although we did not see the force of some of the rules proposed by that gentleman, he had apparently been to a considerable amount of trouble in investigating the matter; and, in the end, produced a far more creditable attempt at efficiently dealing with fire risks from the electric light than the pamphlet before us.

In no part of this report is any suggestion thrown out as to any simple or convenient means of following up the outlined ideas of the Committee. The Society of Telegraph Engineers should be aware that the electric light engineer of the present day is in almost every instance a creation of the last three or four years, and that many hints which may be quite apparent to a professional electrician require a simple explanation or example to be of service to the latest comers in electrical work. For instance, if we take the following example it will illustrate our meaning:—Rule 15 reads, "All wires used for indoor purposes should be efficiently insulated." Now what will this convey to the mind of a man who does not know in what terms the meaning of insulation is expressed, or in what degree the different properties of insulating materials may vary. The only service which we can imagine this pamphlet will render towards the object in view is in the strongly-urged remark, that the chief element of safety is in the employment of skilled and experienced electricians and in the frequent testing of the wires.

As a recommendation from the Council of the Society of Telegraph Engineers and of Electricians the Report is utterly unworthy of the Society's reputation. The subject is merely touched upon, and that in the flimsiest manner, and although the intention of the Committee may have been a good one we can only come to this conclusion, that it has failed unmistakably in producing a work which will ever be looked upon as authoritative, useful, or containing anything whatever beyond that which electric light engineers already know. We are sorry that so many eminent men should have allowed this pamphlet to be brought forward with their sanction. England is looked upon by Continental and American electricians as the leading country in electrical science, but we do not think that any prominent body of engineers abroad would produce such a miserable offspring as that brought forth by the Society of Telegraph Engineers and of Electricians.

ARC ELECTRIC LIGHTS FOR LARGE INDOOR SPACES.

IN our columns of this week will be found an interesting description of the lighting of the telegraph office at North Brussels by the Jaspar system of arc lamp. Although this installation was commenced as long since as 1879, we have thought it sufficiently interesting to place before our readers for various reasons. In the first place, very little has been heard in England respecting the performance of the Jaspar system; and this, in connection with the mirrors and reflectors employed for equalising the light throughout large rooms, and the manner in which it was performed will, we feel sure, form a theme of general interest. In addition to the admirable way in which the lamps were disposed for the particular purpose assigned to them, the whole arrangement of the installation was carried out in a more minute and exhaustive manner than we remember to have seen either previously or since. Not a single point seems to have been omitted, and the experiment has more than a local significance as far as arc lamps are concerned, and the best carbons for employment therein. The nearest approach to the method of lighting adopted in the Jaspar system has been shown experimentally on several occasions, by Messrs. Siemens Brothers, who have thrown their light upwards, and thus allowed it to be reflected from the ceiling, or from suitably arranged reflectors, over a large space. But it is to the peculiar and ingenious arrangements of the mirrors and reflectors in the North Brussels Telegraph Office that we would call attention, for the large amount of light given by an arc lamp is there utilised to the greatest extent. As generally employed there is an enormous waste of light, and this matter has not yet been handled with a view of eliminating such loss. It has always appeared an odd thing, that after producing a certain intensity of light by means of a given current strength, we should at once reduce it one-half at least by enclosing the lamp in a thick opal glass globe. This may be perhaps essential in street lighting, but for factories and warehouses, it seems that such a device as that used at North Brussels might be profitably employed in England.

THE ELECTRIC NEWS-TELEGRAPH COMPANY.

UNDER the above title a new company has lately been brought before the public, which practically proposes to work in competition with the already established and well-known Exchange Telegraph Company. The latter, seeing that the base on which they stand is likely to be somewhat shaken, and the monopoly which they have hitherto enjoyed curtailed, seem to be doing their best to throw discredit upon the operations of their antagonist. The chief advantage which the new comers put forward as regards the instruments they intend to use is, that the apparatus only requires one wire to work it. The prospectus states that the apparatus "is remarkable for its simplicity, and is thoroughly reliable in action, the whole of its varied movements being regulated by one single wire. . . . The apparatus itself, which is small (and is almost silent in action), is fixed under a glass cover on a stand in the room or office of the subscriber, and by means of a paper tape contained within the machine, the news transmitted is printed in ink in large and legible characters upon the tape, both in words and in figures, without the intervention of any person whatever. . . . ." The machines have not any contact points, and are believed to be worked with some 60 per cent. less battery power than any existing instrument employed for a similar purpose. In a letter from Sir Charles Bright, the latter says: "The apparatus comprises several technical improvements of a novel and very ingenious character, one of which is a peculiar self-adjusting appliance by which the mechanism is brought into perfect unison at short intervals, precluding irregularity in working." This unison-adjuster, although referred to in the letter of Sir Charles Bright, is not claimed in the prospectus as one of the advantages of the system.

The Exchange Telegraph Company, in an advertisement which they put forward, almost simultaneously with the issue of the prospectus of the new company, imply that this adjuster is put forward as one of the advantages of the new apparatus, and, moreover, they state that it is an infringement of a patent which is their own property. The Exchange Company further state that "they consider it an error to say that the whole of the varied movements of the instrument in question are regulated by a single wire, as they are partly dependent upon clockwork." They also say: "They have had in operation in London an electrical type-printing instrument for ten years, and although two wires are used for the purpose of giving quotations, this plan has been adhered to by them, and is universally used in America as being admittedly the best for recording the prices of stocks and shares." "The Exchange Telegraph Company have had for the same number of years more than one description of single wire type-printing instrument, with double the speed of any other single wire instrument in this country." The fact that a two-wire instrument has hitherto been considered to be better than one which works with one wire is, we think, hardly an argument that an equally good apparatus with one wire cannot be obtained, and the statement of the Exchange Company seems to imply that the apparatus which they used cannot be improved upon, except perhaps by themselves. The unison-adjuster is such an old idea comparatively that its protection by recent patents is, we think, open to question, unless the arrangement be a very special one, which, we rather fancy, is not the case in the Electric News Company's instrument. The use of clockwork, which enables the working battery power to be considerably relieved, is, in our opinion, no objection, but rather an advantage. We can hardly see by what argument the Exchange Company can say that the clockwork effects the "regulation" of the instrument; the clockwork is regulated, but it does not regulate. From opportunities we have had of seeing the working of the new instruments, we can testify to their efficiency, and to their compact form. The instruments of the Exchange Company, we know, are very efficient, but we cannot agree that their efficiency is so great, and that of the new company so small, as to render the use of the latter undesirable. The Exchange Company, feeling the pressure put upon them, and that their monopoly is slipping away from them, are naturally making every effort to prevent competition; but we doubt whether the statements which they have put forward will help them to any material extent.

CORRESPONDENCE.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number.

DYNAMO-ELECTRIC MACHINES.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—Mr. Riley's letter in your issue of July 1st, taken in the face of your footnote, hardly calls for an answer from me. Perhaps, however, Mr. Riley's mind may be set at rest if I tell him that neither I nor any other patentee can have any right or claim to the outward shape or form of the field electro-magnets of a dynamo machine.

As this appears to be the only point in which Mr. Riley claims any resemblance between the two machines, I trust that this explanation on my part may satisfy his *amour propre*.

I am, Sirs,
Your obedient servant,
HENRY F. JOEL.

July 5th, 1882.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—I have read the letter of your correspondent, Mr. J. S. Riley, in your issue of the 1st inst., in which he claims some similarity between his magneto-electric machine and that of Mr. Joel, and alleges that he showed me a photograph of his form early last year.

On looking over the visitors' book I find that a Mr. Riley visited the Library several times last year, and it is possible he may have shown me the photograph he refers to, but I am quite unable to say what were the principal features of his machine, or whether there is any similarity between it and the one to which it refers. I am not acquainted with either. Your note appended to Mr. Riley's letter renders any further remarks from me unnecessary.

I would add, however, that if Mr. Riley will examine the specifications of the principal dynamo-electric machines he will find *many* instances in which one machine is similar to another.

I am, faithfully yours,
A. J. FROST,
Librarian, Society of Telegraph Engineers and of Electricians.

July 3rd, 1882.

NOTES.

THE ELECTRIC LIGHT IN THE CITY.—A considerable amount of correspondence is to be found on the subject of electric lighting in the *City Press* of Saturday last. The first is a lengthy and important letter from Mr. Alexander Peebles, in which he analyses the three lowest tenders received for each district to be illuminated. This gentleman bases his facts upon the report of the Commissioners of Sewers, the items of which appeared in the above paper in its issue of June 21st. (See ELEC. REV., June 24th.) There it was stated that the minimum charge for electric lighting in the four districts (three new, and the one vacated by Messrs. Siemens Bros.) was £9,930, as against gas £1,867 for the same area. This comparative estimate Mr. Peebles says is upon a wrong basis; hence his letter. In his tables the following data occur:—

> District No. 1, comprising Newgate Street, Giltspur Street, Smithfield (S.E. and N.E. sides), Long Lane, Aldersgate Street (from Barbican to St. Martin's-le-Grand), and St. Martin's-le-Grand.—For lighting this district by electricity eight tenders were received, the three lowest being as follows: 6th, 1¾ per cent. more than gas; 7th, fully 5 per cent. less than gas; 8th, nearly 10 per cent. less than gas.
>
> District No. 2, comprising Threadneedle Street (from front of Royal Exchange to Old Broad Street), Old Broad Street, New Broad Street (from Liverpool Street to London Wall), Liverpool Street (from New Broad Street to Bishopsgate Street), Bishopsgate Street (from Liverpool Street to Cornhill), and Cornhill.—For lighting this district by electricity seven tenders were received, the three lowest being as follows: 5th, fully 54 per cent. more than gas; 6th, fully 11 per cent. more than gas; 7th, fully 9 per cent. more than gas.
>
> District No. 3, comprising Leadenhall Street, Aldgate, Aldgate High Street, Fenchurch Street, and Lombard Street.—For lighting this district by electricity seven tenders were received, the three lowest being as follows: 5th, fully 64 per cent. more than gas; 6th, fully 14 per cent. more than gas; 7th, fully 11 per cent. more than gas.
>
> District No. 4, vacated by Messrs. Siemens Bros.—For lighting this district by electricity seven tenders were received, the three lowest being as follows: 5th, 17½ per cent. more than gas; 6th, 1¼ per cent. more than gas; 7th, 3½ per cent. less than gas.
>
> Upon adding together the estimated annual cost of the present gas light in these districts, it amounts to £1,867, whilst the four lowest tenders for the electric light amount to £1,863, but in this comparison gas has had the advantage of all the improvements in its manufacture which have been discovered since its introduction, and it is generally understood the gas companies do not regard street lighting as a source of profit, whilst electric lighting is, comparatively speaking, in its infancy, and in these tenders street lighting is alone included.

A second letter, by an anonymous contributor, relates to the apparent irregularity of prices charged for each district during last year's experiments, whilst a third emanates from W. J. Elliott, the gentleman who, on the strength of having tried to fire a gun by electricity, gives it as his opinion that the system of division and subdivision of the electric light as exemplified in the installation of Mr. J. B. Rogers is the best before the public.

In connection with the subject of private lighting we read in the *City Press* of Wednesday that at Tuesday's meeting of the Commission of Sewers—

> The Clerk (Mr. Blake) read a petition from the Electric Light and Power Generator Company, and the Hammond Electric Light and Power Supply Company (Limited) stating: "That in tendering to

your Commission your petitioners have estimated that the lighting of the streets would be for one year only, and experimental in its character, and your petitioners have therefore been obliged to take into account that part of their plant and materials would be useless at the expiration of the year; but if your honourable Court see fit to give the light some permanency of character your petitioners would be able to make a lower tender. Your petitioners desire to point out that so far as regards the lighting of shops and warehouses they could do so by means of running cables into the shops and warehouses from the street. Your petitioners also desire to point out to the Commission that the lighting of shops and warehouses of private persons is a most remunerative undertaking, and if your Commission think fit to give to your petitioners and to the ratepayers the right of coming to an agreement with reference to private lighting *en route* your petitioners would be in a position to make a tender very much lower than they have hitherto been able to do." Mr. F. Green moved that the petition be referred to the Streets Committee, which was agreed to. A letter from the Pilsen Company to the same effect, and a petition from City merchants and traders, asking that the subject of private lighting by electricity might be speedily settled, were also referred to the Streets Committee for consideration and report.

"Truth" and the Electric Light.—Of late a number of scathing, not to say worse, articles have appeared in *Truth* on electric light companies, chiefly attacking the Brush Company and the Sellon-Volckmar accumulator affair. An extract from the columns of this journal of June 29th reads as follows:—"The Brush Company, the most prolific and the most impudent of these companies, has for its vice-chairman Mr. Sellon, who, it has been proved, sold an utterly valueless 'patent' to a company for £340,000, and Sir Henry Tyler, who apparently makes a business by directorships, is its chairman." We think it is really time that these two gentlemen should take steps to defend themselves from these attacks, for the reputation of those associated with them, if not for their own sakes.

Electric Light Patents.—We read in *Truth* that "not one vestige of evidence is adduced of the commercial value of the so-called patents." We do not quite see how the progress of electric lighting during the past four years could have so far advanced as we now see it in the present day had not the various patents taken out during this period presented some advantages over that which was public property anterior to these inventions. Surely if a man produces some *actual* improvement on what is known, and which improvement would by its adoption have a beneficial effect on any given system of electric light, he is entitled to some substantial reward as the result of his mental labour? If then any company can see that its operations will be assisted by the employment of something for which a certain sum is asked, it seems evident that the "something" has a commercial value. We will say, however, that sums have been paid utterly out of proportion to the actual value of the invention; but that does not seem to be the point at which *Truth* is aiming.

The Fyfe-Main Arc Lamp.—We hear on good authority that in addition to the six lamps already in operation at the new offices of the *Daily Telegraph*—and which, we are informed, give great satisfaction—Mr. Alexander Fyfe is busily employed in fitting up six more in the printing rooms, and that he will extend the system as far as his motive-power will allow, the engine at present supplying the driving power for the dynamo-electric machines being one by Marshall and of 10 horse-power nominal.

Electrician Wanted.—We beg to call the attention of electricians to our advertisements, in case they might pass them by when first perusing our columns.

Electrical Appointment.—We are informed that Mr. A. F. A. Hervey, late assistant to Messrs. Woodhouse & Rawson, engineers and electric light contractors, has received the appointment of engineer to the Australasian Electric Light Company (Brush system), and he leaves on the 13th inst. for Australia. Mr. Hervey has the advantage of having made the subject his profession, and as he was for a number of years employed in India with the late Mr. Louis Schwendler, he has met with more than ordinary opportunities of acquiring knowledge in all branches of electrical science. We believe for the first eight months or so Mr. Hervey will be travelling through Australia and New Zealand with Sir Julius Vogel before beginning his practical work.

Personal.—We believe that Mr. A. Le Neve Foster, who has been so long connected with the India-rubber, Gutta-percha, and Telegraph Works Company, of Silvertown, as chief of the instrument department, has now left that company and associated himself with a manufacturing company carrying on operations in the country. Mr. Foster is so well known amongst electricians that it is hardly necessary for us to say that anything he undertakes will be entered into with a thoroughness and knowledge of every part of his profession which will leave nothing to be desired. We shall be glad to hear of Mr. Foster's success in the future.

The Post-office and the Telephone.—It is brought to us on reliable authority that the Postmaster-General contemplates giving up the erection of private telephone lines, and as far as exchanges are concerned, the Post-office authorities will not interfere as long as their own interests are not invaded. It appears from this, therefore, that telephone exchanges, with but few exceptions, will soon be thrown open to all. Should this be true, a great impetus will be given to telephony, which is, comparatively, now almost at a standstill. Albeit the telephone is the most wonderful invention of the age.

The London and Globe Telephone Company.—Referring to the above note, it will be within the memory of our readers, that this company applied some time since for licences to open exchanges in many towns in England, amounting altogether, we believe, to some 160 or thereabouts.

Telephonic Communication with a Congregational Church.—Telephonic communication (says the *Greenock Telegraph*) was on Sunday established between the residence of Mr. John M. Hutcheson, Thorndean, and the George Square Congregational Church, Greenock. The experiment was an entire success. Several persons in the Exchange, at Watt Place, heard the whole service quite distinctly, and even at Glasgow some passages of the Rev. J. M. Jarvie's remarks were written down and repeated to the people in the Greenock office, to show how clearly the sermon had been heard so far away. Mr. Hutcheson himself says that he did not miss a single word of the forenoon service, and that the musical part of the service was particularly well heard by him.

The West Coast of America Telegraph Company's Cables.—We read the following in the *Panama Star and Herald* of June 8th:—

> The cable of the West Coast of America Telegraph Company, from Mollendo to Chorillos, was successfully repaired in the early part of May, by their engineer, Mr. E. W. Parsoné, in the ss. *Retriever*. The break was off Point Pescadero, in about 800 fathoms of water. At that depth it was recovered with difficulty, rendered all the more so by a very singular circumstance. The country near the situation of the fractures, some 400 nautical miles or more South of Chorillos, is as barren of all kinds of vegetation, trees, or shrubs, as any part of the coast of Peru.
>
> Notwithstanding this, the cable when raised to the surface, brought up great masses, tons in weight, of trunks, roots, and branches, apparently of well-grown olive and other trees. Here is a chance for some of our *savants* to tell whence came these trees, branches, roots, &c., so far from the shore, and in water nearly a mile deep. It cannot be accounted for by a submersion of any portion of the coast of Peru in any times known to history, since we have no such record. Nor have any notable land slides occurred by which such ligneous growths could have been swept from the land into the sea, to be imprisoned at its depths by the earth or portions of rocks still clinging to them. Probably in times of which history or Indian tradition make no note, in some convulsion of nature on that coast, so frequently stricken by earthquake or tidal wave, that portion of the coast was submerged and carried with it to the depths of the sea, the human beings who inhabited its lands, their dwellings, and their wealth, and the gardens and orchards they cultivated. At the depth at which these curiosities were found, decay would scarcely affect them.

The Post-office Cables.—The Post-office authorities have again chartered the London and Edinburgh Shipping Company's steamer *Morna* for the purpose of repairing their faulty cables in Shetland, and on the West Coast of Scotland.

Telegraph Cables.—In the House of Commons on Tuesday last Mr. Monk asked the Under-Secretary for Foreign Affairs whether Her Majesty's Government had taken any steps, in concert with other nations, with a view to the protection and preservation of telegraph cables, and whether it was proposed to send a representative from this country to the conference of European maritime countries to be held in the autumn? In reply, Sir Charles Dilke said Her Majesty's Government accepted an invitation from the French Government to take part in a conference on this subject, which was to have met at Paris on the 1st of last month. The French Government, however, postponed its meeting until the autumn. Her Majesty's Government are of opinion that advantage might be taken of this delay to settle beforehand the scope of the labours of the conference. They are at present in communication with the French and other Governments concerned, and if an understanding is arrived at on this point they will be represented at the conference.

UNDERGROUND CABLES IN GERMANY.—A commencement has been made in Strasburg with the laying of the underground cables intended to replace the overhead wires, which start from the Telegraph Office of the Quai de Paris, some in the direction of the covered bridges and others in a parallel direction to the Faubourg de Saverne. The cables are laid in a trench, about one metre deep (3·28 ft.), which from the building of the central telegraph office, passes over the Bridge de Saverne, under the footpath on the right, and then along the right side of the Faubourg de Saverne, as far as the embankment of the new railway station. In this trench four cables will be laid, each composed of seven telegraph wires for the lines to Paris, Weisenburg, Lauterburg, &c. A second trench starting as well from the Quai de Paris and following the left side of the Quai de Saverne, will be dug along the Quai Saint Jean, through the large street de la Course, as far as the central railway station, and in this trench six cables will be laid, each composed of seven telegraph wires, and intended for the traffic over the lines to Basle, Kehl, Molsheim, &c. One of the cables will be laid in the Küss street, in order to establish a direct communication between the central railway station and the telegraph office of the Quai de Paris. The cables then follow the different lines which start from the new central railway station, and are continued till outside the new fortifications, when the telegraph wires become again overhead wires.—*La Lumière Electrique*.

THE BONE-BISERTE CABLE.—The French Government telegraph steamer *Charente* started laying this cable from Bone, on the 21st ult., and we read in the *Petit Marseillais*, of the 28th ult., the following:—"The laying of the submarine telegraph cable between Bone and Biserte has been successfully completed last night. The cable between La Calle and Biserte will be worked as before, to relieve the traffic. Another Director of Posts and Telegraphs, M. Cayler, is expected, to replace M. Rubichon, who is allowed to retire on a pension. It has been found necessary to re-arrange the Tunisian telegraph staff owing to the great devolopment of that service with Tunis."

MEXICAN CABLES EXTENSION.—The ss. *G. E. Wood*, chartered by the India-rubber, Gutta-percha, and Telegraph Works Company for the Mexican Cables Extension safely returned from Mexico on Monday the 3rd inst. She is now discharging, off the Silvertown Works, the cable stores, machinery, tanks, &c., with which she was fitted for that expedition.

THE CABLE SHIP "CAROLINE."—The ss. *Caroline*, chartered for the repairs of the Otranto-Corfu cable, left Messrs. W. T. Henley & Co.'s Works on the 28th ult. We understood that Mr. W. A. Killingbeck went out in charge of the cable staff, but this is not confirmed.

SUBMARINE TELEGRAPHY.—We extract the following from the *Times*, concerning Mr. Jacob Brett and the invention of submarine cables. A correspondent writes:—

> Mr. John Watkins Brett and his brother, Mr. Jacob Brett, may unquestionably be designated as the original projectors (if not inventors) of the Submarine Telegraph, for as far back as July, 1845, the Messrs. Brett registered their plan for an oceanic or submarine telegraph, and in the same year took out patents for the construction of subterranean lines. In 1847 they obtained permission from the Government of Louis Philippe to establish a submarine cable between the coasts of France and England, but were unable to obtain any support from the public to carry out the undertaking. In 1849 a concession for the same object was granted to them by Prince Louis Napoleon, then President of the French Republic, and in 1851 the Submarine Telegraph Company was formed, and a substantial cable containing four conducting wires, and protected by a coating of strong iron wires, was laid between Dover and Sangatte, near Calais, and this cable is at the present moment in excellent working condition. Mr. John Watkins Brett became afterwards one of the founders of the Atlantic Telegraph, and also of various telegraph lines in the Mediterranean. He died in 1863, leaving only a moderate fortune to be divided among a numerous family of brothers and sisters. Since that time Mr. Jacob Brett, who is now seventy-four years of age, has fallen into most serious pecuniary difficulties, and at the present moment is absolutely without a home or any means of supporting himself. A committee, consisting of Sir James Carmichael, Chairman of the Submarine Telegraph Company, and other gentlemen interested in telegraphic enterprise, has therefore been constituted to promote the subscription of a fund in aid of Mr. Jacob Brett, to which the Submarine Company have given £200, and an appeal is confidently made on his behalf for further assistance to those companies and individuals, as well as to the public in general, who have derived such great benefits from the establishment of the Submarine Telegraph. It must be remembered that if the earlier experiments of Messrs. Brett had ended in failure, the world might have been long deprived of that invention which Lord Granville has so happily termed "the wonderful instrument of communication of thought."

Sir J. R. Carmichael writes from 2, Throgmorton Avenue, London, E.C., July 1st:—

> With reference to a communication respecting "Submarine Telegraphy," which is published in the *Times* of to-day, may I be permitted to add that Messrs. Ransom, Bouverie, and Co., of 1, Pall Mall East, have kindly consented to receive any subscription to the "Benefit Fund" in aid of Mr. Jacob Brett, which is alluded to by your correspondent.

TELEGRAPHS IN CHILI.—The *Chilian Times*, of May 13, says:—

> The improvement and extension of the State telegraph system is under the consideration of the Government. In a report of the 2nd inst. the Director-General of Telegraphs recommends the establishment of offices at Pena Blanca, Paiguano, Tongoy, Panulcillo, Palmilla, Matanzas, San Antonio de las Bodegas, Llico, Vichuguen, Curepto, Florida, Curanipe, and Castro, the last-mentioned place being on Chiloe Island. The estimated cost of the extensions is a little over 74,000 dollars. The director also points out the necessity of laying an additional wire from Iquique to Canete, the present line being totally inadequate to meet the requirements of the public. If the proposed extensions should be carried out, and we presume they will be, the total length of the State telegraph lines will be 14,265 kilometres.

LAUNCH.—On the afternoon of Thursday, the 29th ult., Messrs. John Elder and Co. launched, from their Fairfield Works, Glasgow, the steel paddle-ship *Normandy*, constructed by them for the London, Brighton, and South Coast Railway Company, and the Western of France Railway Company. The *Normandy* is similar to, though somewhat larger than, the *Victoria* and the *Brighton*, owned by these companies. She will be very handsomely fitted for 100 first-class and seventy second-class passengers, and every convenience necessary for the channel passage, including electric bells and the electric light, will be provided.

MAGNETIC OBSERVATIONS AT THE PARIS OBSERVATORY.—We are glad to learn that owing to the exertions of Admiral Mouchez magnetical observations will soon be resumed at the Paris Observatory in subterranean chambers, which have been excavated in the newly annexed ground. These observations will be self-registering by photography, in conformity with the instruments established by M. Mascart at the Collége de France. Direct observations will also be taken with the old instruments, which were used by Arago, who was famous for his prognostications of auroræ at a period when, the electric telegraph not having been invented, many days must elapse before the arrival in Paris of news from the northern parts of Europe.

ON THE CHEMICAL WORK PRODUCED BY THE BATTERY.—By M. D. Tommasi.—Joule and Favre have shown that the power of the galvanic battery has a close relation with the heat which the chemical reactions in the battery itself produce. An entire order of questions respecting currents may be treated as calorimetric problems. The electromotive force of a battery is proportional to the heat evolved by chemical action, and thus if we know the number of calories disengaged by such action we may arrive at the work which the battery is capable of performing. Favre, however, has pointed out that the heat brought into play during the combustion of the hydrogen in electrolysis is transmitted or not transmitted to the circuit according to the nature of the compound which furnishes the oxygen necessary for such combustion.

Thus, *e.g.*, of 131 cal. evolved by an element with oxygenated water and hydrochloric acid, there are merely 41·6 cal. which are transmitted to the circuit, and which consequently represent the energy of the battery. Favre observed, further, that in the sulphatation of the zinc of a simple element (zinc, platinum, and acidulated water), 39 cal. are brought into action; but of this number 29·8 cal. only are transmitted to the circuit, whilst 9 cal. remain in the interior of the battery.

I will first examine this latter case, as being the most simple, and will treat afterwards of the calories evolved in elements with two liquids.

1st. A zinc-platinum element with dilute sulphuric acid (Smee's battery) evolves, according to Favre, 39 cal.; but of this number there are only 29·8 cal. transmitted to the circuit, and representing the energy of the battery. It would then follow that two such elements could not decompose water. In fact,

$$29{\cdot}8 \text{ cal.} + 29{\cdot}8 \text{ cal.} < 69 \text{ cal.}$$

But I have shown that the decomposition of water takes place conformably with what might have been expected if all the calories disengaged by the two elements had been transmitted to the circuit. Thus,

39 cal. $+ 39$ cal. > 69 cal. (Favre), or 38 cal. $+ 38$ cal. $+ 1$ cal. > 69 cal. (calculated from the most recent thermic data).

If the water of the voltameter is acidulated with hydrochloric acid the decomposition of the water is facilitated, as might be foreseen, knowing that the electrolysis of dilute hydrochloric acid absorbs per two molecules merely 66 cal., in place of 69. But even in this case there should be, according to Favre, no electrolysis, since $29{\cdot}8$ cal. $+ 29{\cdot}8$ cal. < 66 cal.

If, in the preceding elements, we substitute for the two platinums two plates of graphite previously heated to redness, which ought not, according to received ideas, to modify the chemical action of the battery, the decomposition becomes very brisk. But if we use electrodes of coke with a large surface the decomposition of the water is, beyond comparison, more energetic.

2. According to Favre, two zinc-platinum elements with dilute hydrochloric acid ought not to decompose water if acidulated with sulphuric acid, but should decompose it if acidulated with hydrochloric acid. In the former case we should have—

$33{\cdot}4$ cal. $+ 33{\cdot}4$ cal. > 69 cal.; but in the second—

$33{\cdot}4$ cal. $+ 33{\cdot}4$ cal. < 69 cal. In fact, two such couples do not decompose water if acidulated with sulphuric acid, but the decomposition ensues if the water is rendered acid with hydrochloric acid. Two zinc-graphite elements, or preferably two zinc-coke elements, decompose briskly water acidulated with sulphuric acid. It is the same if we use a zinc-carbon element along with a zinc-platinum, though in this latter case the action is more feeble. In either case the decomposition cannot be explained according to Favre, but it is intelligible on thermic principles. $34{\cdot}2$ cal. $+ 34{\cdot}2$ cal. $+ 1$ cal. > 69 cal.

3. A zinc-platinum element in dilute hydrobromic acid ought to develop according to Favre, 35·9 cal., of which only 29·9 are transmissible to the circuit. Consequently two such elements ought not to decompose water acidulated either with sulphuric or hydrochloric acid; if the water of the voltameter is acidulated with sulphuric acid, we observe a beginning of decomposition, which soon comes to an end. The decomposition of water is more marked with a zinc-graphite and a zinc-platinum element, and better still with two zinc-graphites. It is most energetic with two zinc-coke elements. If the water of the voltameter is acidulated with hydrobromic acid there is also electrolysis; but it is not the water which is decomposed, but the hydrobromic acid itself. Whatever the degree of dilution of this acid, we always see an escape of gas at the negative electrode; whilst at the positive electrode there is no escape of gas, but a yellowish thread of bromine is formed round the platinum wire. This fact is easily explained, since 2 molecules of hydrobromic acid absorb 59 cal. for their decomposition, whilst 1 molecule water absorbs 69 cal.; so it is always the compound which absorbs least heat, which is decomposed in preference by the current, as the author showed in 1879.—*Comptes Rendus.*

ON THE INFLUENCE OF THE POSITIVE ELECTRODE OF THE BATTERY UPON ITS CHEMICAL WORK.—By M. D. Tommasi.—In my researches upon electrolysis I have ascertained the singular fact that the electromotive force of one and the same couple may vary according as the positive electrode is of platinum or of coke. An element, *e.g.*, which is incapable of effecting the electrolysis of water or a saline solution, although the calories which it disengages are greater than the calories absorbed by the decomposition of the electrolyte, if its positive electrode is of platinum, becomes able to produce such a decomposition if its positive electrode is of coke. As this fact is of great importance as regards the relation which I am seeking to establish between the calories liberated by the battery and the calories absorbed by the decomposition of the electrolyte, I have examined it in some detail, and have made the following observations:—

A magnesium platinum couple in dilute sulphuric acid ought, according to thermic data, to decompose water; the number of calories liberated by the action of magnesium upon dilute sulphuric acid (112) is greater than the number of calories of the decomposition of water (69). Nevertheless, the decomposition does not take place. It is the same if we substitute copper or silver for the platinum of the element, but if we use as a positive electrode a cylinder of graphite or of coke, the electrolysis of the water takes place.

According to M. Berthelot, two zinc-platinum elements with dilute sulphuric acid do not decompose a solution of sulphate of potash. But on employing two zinc-carbon elements with dilute sulphuric acid, I have been able to electrolyse a saturated solution of sulphate of potash with a copious liberation of gas at the two platinum electrodes, and a transfer of the acid to the positive electrode and of the base to the negative electrode, and this in the lapse of a few minutes and at the common temperature. There are required, according to M. Berthelot, at least 103 cal. to electrolyse a solution of sulphate of potash, whilst I obtain this same decomposition with 76 cal. and even fewer, for it is produced with two zinc-carbon elements and dilute hydrochloric acid, say with 69·8 cal. (calories disengaged by the action of a molecule of amalgamated zinc upon dilute hydrochloric acid). A single zinc-coke element with dilute sulphuric acid decomposes sulphate of potash if the electrode of the voltameter is of copper, but not if the electrode is of silver.

I have submitted various salts to electrolysis. The conditions of the experiments are as follows:—The saline solutions contained an excess of salt. The platinum wires of the voltameter were 0·4 mm. in diameter, and plunged into the liquid to a depth of 0·3 to 0·4 metre. The carbons employed were Siberian graphite or gas-coke previously heated to redness and cooled in a stoppered bottle containing air, nitrogen, and by preference, carbonic acid. To obtain good results, the coke or the graphite should remain at least six hours in contact with carbonic acid. The presence of this gas in the pores of the coke has no other object than to retard the polarisation, rendering consequently the effects more intense and giving them a longer duration. Two zinc-carbon elements with dilute sulphuric acid (= 77·4 cal.) decompose the following saline solutions:—Sulphates of magnesia, zinc, cadmium, copper, manganese, iron, chloride, bromide, and iodide of potassium.—*Comptes Rendus.*

OBSERVATIONS ON ELECTRIC FISHES.—By Herr G. Fritsch.—The author during a sojourn in Egypt has made a series of anatomical and physiological observations on *Malopterurus electricus*. He has also confirmed the suggestion of Babuchin that *Mormyrus* also is an electrical fish. From a very lively specimen of *Mormyrus oxyrhinchus*, 165 millimetres in length, he obtained in two and a half hours twelve electric discharges. This small fish did not live long, and the author did not possess the apparatus necessary for determining the direction of the discharge. As, however, the genus *Mormyrus* is rich in species, now their electric properties are recognised it will not be difficult to study them more closely.—*Du Bois Reymond's Archiv.*

On the Dispersive Power of Electricity.—By L. Palmieri.—If the bifilar electrometer of Palmieri receives either a positive or a negative charge the losses of electricity in a space protected from currents of air are in equal times rather greater for a negative charge than for a positive. The differences are greater in dry weather, and disappear in very moist air.—*Wiedemann's Beiblätter.*

Means of Rendering the Holtz Machine more Active.—By C. Marangoni.—The discs are freed from varnish, steeped in distilled water for twenty-four hours, set to dry in a vertical position without touching anything, and re-introduced into machine. It acts then again for some time in a protective case. The discs, therefore, are not to be varnished. The machines are excited by a gutta-percha plate better than by ebonite.—*Wiedemann's Beiblätter.*

The Electric Tensions between a Metal and Liquids of Different Concentration.—By Erasmus Kittler.—The author has made a long series of determinations of the differences of tension of certain chlorides in various combinations. The results are here given, our readers being referred to the original for the details of the observations.

If in the combination : copper | solution + solution | copper sulphate + copper sulphate | copper, there are substituted successively the concentrated aqueous solution of chlorides of potassium, sodium, ammonium, lithium, calcium, strontium, barium, magnesium, manganese, and nickel, there are obtained on using a dilute solution of sulphate of copper (0·6 parts to 100 of water) the following electromotive forces: chloride of ammonium = 0·318 Daniell; chloride of potassium = 0·315 D.; chloride of lithium = 0·308 D.; chloride of calcium = 0·304 D.; chloride of sodium = 0·302 D.; chloride of strontium = 0·290 D.; chloride of magnesium = 0·275 D.; chloride of barium = 0·251 D.; chloride of manganese = 0·247 D.; chloride of nickel = 0·231 D. The series in which these chlorides fall remains the same if distilled water is used instead of solution of sulphate of copper.

If dilutions of these chlorides are used instead of saturated solutions the electromotive force of the elements decreases with the proportion of the salt in the solution, whether in presence of sulphate of copper or of distilled water. The influence of the concentration of the chlorides upon the electromotive force is very considerable. The difference is greatest with chloride of ammonium, and smallest with chloride of sodium.

The arrangement : copper | $L_1 + L_1$ | $L_2 + L_2$ | copper, in which L_1 and L_2 represent saline solutions of different degrees of concentration, give a current in the direction from L_1 to L_2. The current consequently passes from the chloride to the sulphate of copper, or to water, and from the more concentrated to the more dilute solution.

Volta's law of tension holds good for solutions of the above chlorides of different strengths in contact with distilled water, and a solution of sulphate of copper.

The combination : copper | solution + solution | sulphuric acid + sulphuric acid | copper, yields for the saturated solutions of the chlorides above mentioned a different series than the above combination with sulphate of copper. Here chloride of calcium gives the greatest electromotive force = 0·335 D.; then follows chloride of strontium = 0·334 D.; chloride of lithium = 0·323 D.; chloride of magnesium = 0·321 D.; chloride of manganese = 0·294 D.; chloride of ammouium = 0·283 D.; chloride of sodium = 0·287 D.; chloride of nickel = 0·265 D.; chloride of barium = 0·254 D.

Here also the electromotive force decreases with the proportion of salt in the solution, but the influence of the degree of concentration is here more prominent than in the former combinations. The current passes in this combination from the chloride to the acid, but if very dilute solutions are used, from the acid to the chloride or to water; the law of tension does not hold good for the chlorides in contact with dilute sulphuric acid. The electromotive force of the liquid combination : sulphate of copper | solution + solution | sulphuric acid + sulphuric acid | sulphate of copper, in which the members, sulphate of copper and sulphuric acid, remain constant, changes considerably with the proportion of saline matter in the solution—*Naturforscher & Annalen der Physik.*

On the Law according to which the Electromotive Force of a Magneto-electric Machine varies as a Function of the Resistance of the Exterior Circuit.—By M. Marcel Deprez.—The author, in his experiments on dynamo-electric machines, has been struck with the fact that the electromotive force developed in the ring of these machines not merely does not increase infinitely with the intensity of the current which traverses the inducing electro-magnets, but even decreases very notably, whilst the current produced increases more and more.

He has thus been led to think that the electromotive force developed in the ring of a magneto-electric machine, whose magnetic field is constituted by a permanent magnet, is not constant, as has been hitherto admitted, but is a function of the intensity of the current developed in the ring.

To verify this supposition, he has kept the magnetic field of a Gramme machine constant by exciting the inducers by means of an auxiliary source, and has examined how the electromotive force of the ring, turning at the same velocity, varies on closing the outer circuit with more and more feeble resistances. The experiments, given at length in the original memoir, show that the electromotive force developed on the ring decreases when the intensity of the current produced augments. They show also distinctly that the constant fall in the "characteristics," when the current produced becomes very intense, depends on the insufficiency of the inducers. These are, indeed, never too powerful, which is an additional argument in favour of large machines, as the author has demonstrated both theoretically and experimentally that a magnetic field of given intensity is the less expensive to obtain, as it is produced by electro-magnets of more considerable dimensions.

As for the cause of this phenomenon it may be explained as follows : suppose that the passage of the current is suppressed in the inducers and only let pass in the ring, the latter becomes a powerful magnet, the polar lines of which coincide with the diameter, which passes through the points of contact of the brushes and the collector.

If we invert the operation by suppressing the current which traverses the ring, and re-establishing that in the inducers, the polar line coincides with that of the inducers. Hence it results that when the current traverses at once the ring and the inducers, the line of the poles of the ring occupies a position intermediate between the two extreme positions just defined, and may even be determined by that of a construction analogous to that of the parallelogram of forces. It is easy to see, on applying this construction, that the polar line of the ring approaches so much the more to the line of contact of the brushes as the current traversing the ring is more intense, whilst the maximum difference of the potential between the two brushes corresponds, on the contrary, to the case where the polar line of the ring is perpendicular to the diameter, passing through the points of contact.

This amounts to saying that, in proportion as the intensity of the current traversing the magnetic ring increases, the wires of the ring intersect the lines of force of the magnetic field, comprised between the polar pieces and the ring at an angle which differs more and more from a right angle, which is, as is known, the angle corresponding to the maximum electromotive force.

The sole means of reducing within certain limits the defect inherent in all dynamo-electric machines consists in the use—

1st. Of very powerful inducers, surrounded with a moderate quantity of wire.

2nd. Of brushes of variable level.—*Comptes Rendus.*

Electric Fire Signal.—By M. Carré.—This apparatus consists essentially of an iron wire stretched by a spring which acts constantly, and when the wire is elongated in consequence of a given rise of temperature, it closes an electric circuit in which there is an alarm-bell. The communication is established instantaneously by the rupture as well as by the expansion of the wire.—*Comptes Rendus.*

Remarks on the Use of Zinc-coke Elements in Electrolysis.—By R. Berthelot.—A zinc-coke element cannot be regarded as equivalent to a zinc-platinum element in calculating the quantities of heat set free by the reactions which give rise to the galvanic current. The heat disengaged by the attack of the zinc and the acid is not, in the case of coke, the only heat. The coke exerts in these conditions peculiar and complicated reactions. It absorbs hydrogen and oxygen, and intervenes both by the pure carbon which it contains and by the foreign matters mixed in its mass. This is shown by the researches of M. E. Becquerel (" Annales de Chimie et de Physique," 3rd Série, t. xlviii., p. 256) on the electro-motor of such elements. The author adds that the thermic values which express electrolytic reactions are only established for dilute liquids; the effects due to the separation of a trace of acid and of base in saturated saline solutions cannot be exactly calculated by reason of the changes of concentration and the secondary reactions. The principles of the calculation are the same, but the data are wanting.—*Comptes Rendus.*

Oscillations of the Plane of Polarisation by the Discharge of a Leyden Battery. Simultaneity of the Electrical and Optical Phenomena.—By MM. E. Bichat and R. Blondlot.—We have undertaken to study the rotation of the plane of polarisation in a transparent body under the action of the current of the discharge of a Leyden jar. The experiment was arranged in the following manner: between a polariser and an extinction analyser was placed the transparent body in a coil of long and thin wire, connected with the coatings of a battery. In the circuit was introduced a universal discharger, which permitted the discharge to be produced when the difference of potential is sufficient. At the moment of each discharge the eye placed before the analyser perceives a bright reappearance of light, which shows that the plane of polarisation has deviated.—*Comptes Rendus.*

Remarks on the Production of Lichtenberg's Figures.—By K. L. Bauer.—For several years the author has in his physical class produced the Lichtenberg figures by dusting a smooth even plate of hard rubber (an electrophorus plate) with lycopodium, and then allowing a stream of sparks to pass upon the plate from the knob of a Kleist jar, charged either positively or negatively. This procedure, in which the two customary operations are performed in an inverted succession, may be recommended because, according to the author's experience, it gives fine, well-characterised figures with more certainty than that generally prescribed. Jars of different sizes may be used, on the rods of which conductive buttons of different size, shape, and material may be screwed or fixed. The conductive connection of the knob with the internal coating must remain when the jar is inverted, for the purpose of discharging, so that the rod with its knob is directed perpendicularly downwards. Hence the connection cannot be effected by means of metal chains. —*Annalen der Physik und Chemie.*

On Coloured Sparks and their Production by Internal and External Resistances.—By W. Holtz.—In Vol. iii., p. 626, of the *Beiblätter*, 1879, there appears a notice on the production of coloured sparks which are obtained by interposing semi-conductors between Leyden jars, or using semi-conductors as coatings for the jars themselves. I cannot refrain from pointing out that as far back as 1875 (*Pogg. Annalen*, Ergänzungsband vii., p. 520, 1875) I described at length the production of coloured sparks by external resistance. In 1877 (*Pogg. Annalen*, 160, p. 559, 1877) I showed that the same effect may be obtained by means of internal resistance. I did not remain satisfied with coating the jars with semi-conductors, but I filled the jars with imperfectly conductive liquids instead of an internal coating. Though I have latterly not recommended internal resistances for the above purpose, it is because external resistances are equally efficient and more convenient.—*Annalen der Physik und Chemie.*

NEW COMPANY REGISTERED.

Pyramid Electric Company (Limited).—Capital: £80,000, in £1 shares. Objects: To purchase for £6,000 in cash and £16,000 in fully paid deferred shares the electric inventions of William B. Brain and Radcliffe Ward, and the business carried on by the former under the style of the Electric Blasting Apparatus Company in the Forest of Dean, Gloucestershire. Signatories (who take one share): W. B. Brain, Cinderford; R. Ward (electrical engineer), 7, Northumberland Street, Strand; A. L. Foster, East Hill, Wandsworth; T. S. Collins, Ross, Hereford; R. Ferguson, 7, Oxford Terrace, W.; B. Le Neve Foster, East Hill, Wandsworth; C. W. Parkes, 11, Queen Victoria Street. Directing qualification: £300 of nominal capital. Remuneration: £21 for each meeting, to be divided as the directors may determine. Registered 29th ult. by Charles Doubble, 14, Serjeant's Inn, Fleet Street.

NEW PATENTS—1882.

3039. "Galvanic batteries." C. P. Nezeraux. Dated June 28. (*Complete.*)

3042. "Incandescent electric lamps." F. L. Willard. Dated June 28.

3046. "An improved method of abstracting gold and silver from their ores, by the combined action of electricity and mercury." R. Barker. Dated June 28.

3047. "Telephone receivers." W. Spence. (Communicated by M. Kotyra.) Dated June 28.

3048. "Insulating and protecting telegraph wires and other electrical conductors." G. Macaulay-Cruikshank. (Communicated by W. C. Banta.) Dated June 28.

3054. "Means or apparatus for regulating the production of electricity." J. C. Mewburn. (Communicated by F. Rigaud.) Dated June 28.

3061. "Magnetic compasses." F. Betbeder. (Communicated by E. Bourse.) Dated June 28.

3070. "Electric arc lamps." E. de Pass. (Communicated by C. Roosevelt and B. Adbank *alias* Abakanowicz). Dated June 29.

3073. "Improvements in electric railways or tramways, and in means or appliances to be used in connection therewith, parts of which improvements are applicable to the propelling of vehicles on common roads by electromotive force." H. Binks. Dated June 29.

3079. "Electric lamps." J. H. Johnson. (Communicated by L. Bardon.) Dated June 30.

3097. "Secondary batteries." A. Watt. Dated June 30.

3099. "Preparation of carbon filaments." A. R. Leask and F. P. Smith. Dated June 30.

3101. "An improved arc electric lamp." R. H. Courtenay. Dated June 30.

3107. "Secondary batteries." C. H. Cathcart. Dated July 1.

3108. "Improvements in secondary batteries or magazines of electricity, and in apparatus connected therewith." H. J. Haddan. (Communicated by C. F. Brush.) Dated July 1.

3115. "Generators." L. P. Martin. Dated July 1.

3120. "Galvanic batteries." J. H. Davies. Dated July 1.

3128. "Electric logs, or apparatus for ascertaining the speed of ships and the rate of currents." R. M. Lowne. Dated July 3.

3129. "Machines for generating electricity." T. Varley and H. B. Greenwood. Dated July 3.

3142. "Manufacture of submarine telegraph cables." G. E. Vaughan. (Communicated by S. Trott and F. A. Hamilton.) Dated July 4.

3150. "Dynamo or magneto-electric machines, which also serve as electro-motors." R. Werdermann. Dated July 4.

3160. "An improved method of, and means for, regulating the currents in dynamo-electric machines." W. R. Lake. (Communicated by J. Carpentier.) Dated July 4.

3161. "Incandescent lamps." A. R. Leask. Dated July 4.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

5050. "Apparatus for automatically transmitting and receiving signals, &c." F. R. Francis. Dated November 18. 6d. Relates to improvements in apparatus for automatically transmitting and receiving signals, for denoting places at which attempted burglaries and robberies may be made, and for other purposes, consists in the application, combination, and arrangement of a series of specially constructed commutators or contact makers, in number corresponding with the signals required, or with the rooms, doors, windows, safes, and other parts of buildings or things to which the commutators may be affixed in connection with insulated copper and galvanised iron, or other wires, for communication between buildings or things so fitted as aforesaid, and the nearest police or other stations, and arranged so that each commutator or contact maker is capable of producing one signal only, such signal being the name and number of the building, house, room, door, window, safe, or other thing so fitted, as before mentioned, with the commutators or contact makers, thus showing the precise locality of any attempted burglary or robbery.

5080. "Apparatus for the conduction and distribution of electric currents." R. E. B. CROMPTON. Dated November 21. 6d. The inventor constructs durable and economical insulated conductors, specially suitable among other things for use in electric lighting on a large scale in the following manner:—Copper rods are taken of proper thickness and their ends are enlarged by a suitable tool, and on these enlarged ends screw threads are cut. The ends are thus enlarged to preserve the effective section of the conductor from being reduced at the joint. The pitch of these screw threads is so taken that at each junction, when the rods are placed in the order in which they are to lie in forming the conductor, the screw threads on the two adjacent ends are of slightly different pitch. Over these ends is screwed a sleeve or socket. When this is screwed up in the proper direction it forces the ends of the conductors into very intimate contact. The screw threads on the extreme ends of the rods are stripped for a little distance to allow of the rods being so screwed together, or some other equivalent method is used. The conductors so formed are insulated by placing one or more of them in tubes of convenient section. These tubes will in general be made of cast iron for the sake of cheapness. The conductors may be, if desired, maintained in the proper position within the tubes during the process of insulation by core nails or chaplets, such as are used for the support of the cores of pipes when cast horizontally; the tubes are then placed containing the copper rods in a vertical position, and purified blast furnace slag is poured in so as to form a vitreous insulating envelope, thoroughly insulating and protecting each of the conductors. To insure perfect and intimate contact between the conductors and their insulating envelope, it is preferred to enamel them before placing them in the tubes. After the process of running in the vitreous matter is complete, and it has become hard, the chaplets or core nails are removed. The holes left by them can be filled up with insulating material of any durable kind, and the hole in the tube closed by a screw plug if there is no desire to join a branch on to the main at that point. If however it is intended to bring out a branch from the main at that point, a copper plug of proper length is screwed into the metal of the conductor, and brought out through a porcelain or glass washer, or surround it with other suitable insulating material, so as to prevent it coming into electrical contact with the metal tubes or any other conductor in the tubes or the earth. The branch wires are connected to these copper studs preferably by baring a portion of the branch wire, and after stripping it of any insulating material that may be on it, taking a turn with it under the head of the copper plug before it is screwed down. The hole through which the branch connection is made may with advantage be covered by a cast iron hood or cap screwed down to the outer surface of the envelope, and finally filled with pitch, or gutta percha, or other suitable insulator to prevent the entrance of moisture. The insulating material should if possible be poured in in a fluid state through a hole in the cap, which should finally be secured by a screw plug. The tubes or cases above described in which the conductors are placed are joined by means of short tubes made to slip over and fit somewhat closely upon the adjacent ends of those containing the conductors, and these short tubes are joined to those over which they slip by ordinary gasket and run lead joints, such as are used in the case of cast iron water pipes, or it may be found convenient to use rubber packing, or rubber rings, or other well known modes of making such joints water tight, and at the same time not perfectly rigid, to allow for the movements caused by expansion, settlement of the ground, or other like causes. In the walls of these socket pipes holes are to be left, through which melted pitch or other suitable insulating material can be poured, so as to fill them up entirely after the joints above referred to have been securely made, and the holes are finally filled up with screw plugs. To enable these socket pipes to be used the conductors are made to project such a distance beyond the tubes that contain them as to enable the junctions to be most easily constructed. Fig. 1 shows a transverse section of a tube of cast iron or other suitable material containing two conductors, A, A, of copper enamelled, and these conductors, A, A, are imbedded in and insulated from each other and from the containing tube or case by means of the mass of slag or other suitable vitreous material, B, which fills the remaining space in such case. Where it is desired to bring out branches from the conductors, A, A, there are screwed into the conductors, A, A, copper plugs, *a*, *a*, passing such plugs through porcelain, glass, or other insulating washers, *d*, *d*, which are screwed or otherwise secured into the case, C, and to these plugs, *a*, *a*, are attached suitable connecting wires or leads, by means of the nuts, *b*, *b*, or other suitable connections. Fig. 2 shows by a longitudinal plan view, partly in section, an arrangement of parts adapted for connections of portions of tubes and their contained conductors, A, A. The end portions, e^1, e^2, of the conductors, A, A, are somewhat enlarged, and are formed with screw threads thereon, adjoining ends being as shown alternately formed with threads of finer pitch, e^2, and coarser pitch, e^1, and over these are passed and screwed correspondingly threaded socket pieces, D, D, which thereby hold these parts together. The conductors thence pass into and are embedded in the masses of slag, B, B, partly within the sleeve piece, E, and thence to within the tubes or cases, which are passed to within the spaces, F, of the piece, E, which serves to connect those part tubes. Fig. 3 shows a section of a single core or conductor, A, with its enamel covering, *e*, its insulating coating of slag, B, and containing metal tube, C, which tube may be conveniently formed of wrought iron. This arrangement will be found particularly convenient when two conductors are not required. Fig. 4 shows a section of another arrangement of parts somewhat similar to that shown by fig. 1, but more particularly adapted for being placed in the footways of roads. The like letters of reference indicate like parts, as in fig. 1, and the description thereof applies equally well to this arrangement, except that in this arrangement of tube or case, C, one side (the upper side as shown) is adapted for removal in the form of a lid, C^1, affording means of easy access to the rods or conductors and their insulating covering and the branch connections, and these branches, *b*, are applied from the side of the case, *c*. The covers, C^1, may be roughened or formed so as to afford good foothold.

FIG I

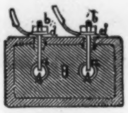


FIG 3

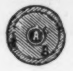


FIG 2

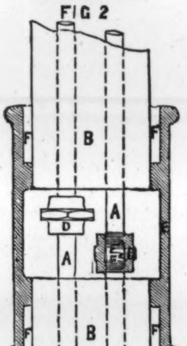
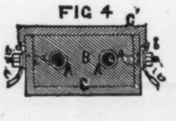


FIG 4



5096. "Electrical commutators." W. R. LAKE. (A communication from abroad by Francis Blake, of America). Dated November 22. 6d. Consists in combining with a pile of plates of metal and hard india-rubber or other insulating material put together alternately, a number of smaller metallic plates, one for each of the electric circuits between which connections are to be made, the smaller plates secured to one of the large insulating plates, and a peg-hole in and through each small plate extending also through all the large plates.

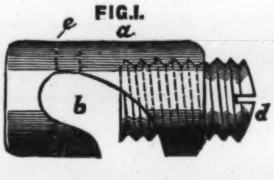
5140. "Telephonic and telegraphic signalling apparatus." A. C. BROWN and H. A. C. SAUNDERS. Dated November 24. 6d. Has for its object improvements in telephonic and telegraphic signalling apparatus. The improvements are applicable mainly where a series of stations are connected by a line wire, and where it is desired that any station may when the line is unoccupied, be able to place itself in communication with any other station on the line, excluding other stations, so that they can neither hear nor interrupt. At each station an instrument is provided with a graduated series of resistances which the operator can insert in the line circuit to vary its resistance. Each instrument is provided with an electro-magnet with armatures held back by springs differently adjusted, or other like contrivance for appreciating the resistance in the line circuit (the battery remaining constant). This appreciating contrivance controls the connections both of the resistances and of the receiver and transmitter, preventing their being placed in effective connection with the line circuit, except the resistance of the line circuit has been set to a pre-arranged quantity. Each instrument is provided with blocking parts, which render the variation of the resistance inoperative in the instrument in which it is produced. This combination works together in the following manner:—An operator wishing to call another station moves a handle to a corresponding mark, and thereby he first blocks and renders inoperative the appreciating contrivance of his own instrument, and then adjusts the resistance of the line circuit. The appreciating contrivances at all the other stations respond, preventing effected connection being established with the line at all stations but the one having an instrument adjusted to the particular resistance which has been brought about. The bell at this station being rung, the operator there moves his handle, thereby blocking his instrument also, and establishing the communication. On the handles being replaced the line is ready for other stations similarly to converse. When an induction coil is made use of in connection with telephonic apparatus, a secondary coil is divided into sections and made use of as resistance to be added to the line circuit to effect the desired adjustment. The coils of the telephone can be similarly employed.

5159. "Galvanic batteries, &c." R. E. B. CROMPTON and D. G. FITZGERALD. Dated November 25. 4d. Relates to the construction of the electrodes of galvanic batteries, especially of the type known as secondary batteries or electro chemical accumulators. In these batteries it is desirable to increase as much as possible the surface of the electrodes, and sometimes to give to them a structure which permits of large quantities of gas being occluded or retained at or near the surfaces. This is accomplished by giving to the electrodes a highly porous structure, and otherwise extending their surface in the following manner:—The electrode is made of a mixture of lead and some other substance capable of being extracted and removed therefrom by the action of water, acids, or other chemical re-agents, or by heat, or by electrolysis. When the mixture has been made into a shape suitable for the electrode the foreign substance is removed, wholly or partially, by some of the means herein before referred to, and the lead of the electrode is left with a porous structure, which greatly increases the surface exposed to the electrolyte, when it is made to form part of a secondary battery.

5198. "Secondary batteries for the production, &c., of electric currents." C. H. W. Biggs and W. W. Beaumont. Dated November 28. 6d. In the usual form of secondary electric batteries, the products of electric decomposition appearing at the poles of the charging battery or dynamo or magneto-electric machine are collected and retained in the charged battery itself. Now according to this invention, the inventors prevent loss of these products, and regulate the recombination of these products in a better manner by collecting and retaining the same in two connected holders, and recombining them in the quantities required in order to produce electric currents.

5226. "Joining branch to main conducting wires for electrical purposes," &c. A. W. Brewtnall. Dated November 29. 6d. Relates to improved means of coupling branch wires to main conducting wires or cables, as required in the installation of electric lamps for example, whereby the connection of the wires may be made, and the insulation of the coupling effected with great ease and rapidity. The coupling consists of a screw stud perforated with a longitudinal hole, through which the end of the branch wire to be connected is passed freely, and having a cross groove in its head at one side, intersecting the longitudinal hole, and forming a hook-shaped jaw fitting upon the main conducting wire or cable (bared of its insulating covering) which lies therein, and is tightly gripped between the jaw and a nut screwing upon the threaded stem of the coupling. The nut presses the main wire or cable forcibly into the jaw and against the branch wire at the intersection of the jaw with the longitudinal perforation, the act of screwing up the nut thus binding the branch wire tightly in the coupling and clamping the latter firmly upon the main wire or cable, thereby insuring a secure attachment and a good electrical connection between the two wires. The figure shows the improved form of coupling. *a* is a cylindrical stud (made of brass or other suitable metal), having a transverse groove cut in it at one side to form a hook-shaped jaw, *b*, to receive the main wire or cable (bared at this point of its insulating envelope), and provided with a binding screw, *d*, screwing into or upon the stud, and with a hole, *e*, intersecting with the groove of the jaw, *b*, so that the wires placed in the jaw and hole respectively shall be in contact at the point where they cross one another. This hole, *e*, passes transversely through the stud, *a*, and the screw, *d*, is a male screw, screwing into a corresponding female screw, tapped in the stud, *a*, and screws up against the main wire or cable lying in the jaw, the act of tightening up the screw forcing the cable into the jaw and into contact with the branch wire, binding the latter tightly in the coupling, thus affording a secure and ready means of attachment and a good electrical connection.

FIG.I.



5229. "Utilisation of electricity for lighting, &c." W. R. Lake. (A communication from abroad by J. S. Williams, of Paris). Dated November 30. 4d. The first part of the invention relates to the development of light and heat by means of electricity, and also to the devices or apparatus to be employed therein or therefor. In order to produce light the inventor causes the electric current to pass through pulverized or granulated particles of conducting material. The material preferred is carbon, but other materials, alloys, or compound substances may be employed. The said material is enclosed in a transparent tube or case, which may be formed of glass or other suitable material, the space or chamber in which the particles are placed being of such form and dimensions as will be best suited for the development of light with economy. By completing the circuit through a conductor composed of particles, granules, or sections, a high resistance is obtained, and heat and light are generated successfully and economically. *(Provisional only.)*

5234. "Fire alarms, &c." W. T. Braham. Dated November 30. 6d. The first part of this invention consists of an apparatus that shall on the occurrence of a fire in its immediate vicinity do any or all of the following acts, that is to say, it may sound an alarum, or alarums, transmit electric currents, or telegraphic signals, to any place or places desired, or turn on a supply of water, through a series of perforated pipes, for the purpose of extinguishing the flames. In carrying out this part of the invention the inventor employs, for the purpose of liberating, or setting the apparatus in motion, a vessel of convenient size, and of a material which is an insulator to electricity, as a glass tube, in which is placed some mercury. Upon the mercury is placed a suitable float, which, when a fire occurs, will be carried upwards by the expanding mercury and come in contact with and liberate a trigger which releases the apparatus. The apparatus is actuated by means of a weight or coiled spring, and when the spring or weight is released, as before described, the revolving barrel, by means of a chain winding round it, draws back a lever and liberates a heavy key, which in falling turns on the water supply. The barrel of the apparatus is connected by cords or wires with a distinct apparatus consisting of a driving barrel, the axis of which carries a wheel, upon which is mounted a revolver charged with blank cartridges. This wheel carries as many studs as there are chambers in the revolver; these, as they rotate, raise a lever, which as soon as a stud has passed it is forcibly driven by a spring on to the revolver nipple, and so explodes a cartridge. A lever having its fulcrum on the framing of the apparatus is connected at one end by means of a wire, or cord, to a bell, the other end of the lever is actuated by successive teeth, or pins, upon a wheel gearing with the driving wheel of the apparatus, so that the bell rings continuously until the apparatus has run down.

5272. "Electric lamps." W. F. King and A. B. Brown. Dated December 2. 6d. Relates to electric lamps of the kind giving light by the arc between carbon points, and it comprises simple and efficient apparatus for moving one or both carbons in a manner to compensate satisfactorily for their gradual consumption, and to keep the light very steady; also automatic apparatus whereby the current supplying two or more lamps is maintained without any (but possibly a momentary) interruption in the event of any one of the lamps ceasing to act, and whereby an extinguished lamp takes its place in the circuit again whenever it has been either automatically or otherwise adjusted or restored to a working condition. In carrying out the invention according to one modification, in which the carbons are in a vertical line, the upper carbon is held by the bottom end of a rod which passes up through a stuffing box into a vertical cylinder of size and length corresponding to the size and length of the carbons employed. A piston working in the cylinder is fixed or connected to the upper end of the rod, and the cylinder is filled with oil or other suitable liquid. The weight of the piston and rod and parts attached to it tends to force the liquid from the bottom end of the cylinder through a small passage or pipe leading to the top of the cylinder, and the rate of flow through this passage or pipe is automatically adjusted to correspond to the rate of consumption of the carbons. For the purpose of the adjustment the passage or pipe has for outlet at its upper end a small port in a horizontal port face, on which there rests a small slide valve; and this valve is connected to the iron core of a solenoid placed horizontally, and to an adjustable spring, the spring tending to open the valve and the solenoid to close it. The electric current working the lamp is made to pass through the coil of the solenoid; and when in consequence of too great separation of the carbon points and increased resistance the current passing through the solenoid is weakened it allows the spring to draw back the iron core and open the valve; and when the carbon points are too near the consequently stronger current causes the solenoid to act on the iron core so as to close the valve more or less and thereby diminish the rate of descent of the upper carbon. When the spring is properly adjusted the action of the parts is to keep the distance between the carbon points practically uniform. The liquid passing the valve flows into the upper end of the cylinder; and when a carbon has been consumed the rod and piston are raised for receiving a fresh carbon, the liquid passing from the upper to the under side of the piston through a check valve in the piston or in a separate passage; or the piston may be constructed so as on being pushed up to positively open a valve or passage through it for the liquid.

5600. "Electric lighting apparatus for railway trains, &c." Sydney Pitt. (A communication from abroad by Eli T. Starr, of the City and County of Philadelphia, America.) Dated December 21. 6d. Relates to an improved organisation of instrumentalities for producing the lights which are required on board of railway trains for illuminating the track at night in advance of the locomotive, and for exhibiting a warning signal in the rear of the train, or for other analogous purposes. The inventor makes use of apparatus for generating or producing electric currents by the conversion of mechanical energy derived from the motion of the train itself into electricity, store a portion of the electricity so produced for use at such times as the train is not in motion, and apply the same to the development of light from electric lamps placed at suitable points upon the train. The invention consists in certain new organisations and combinations of parts or devices.

1882.

931. "Dynamo-electric machines." A. M. Clark. (A communication from abroad by Henry Brinsley Sheridan, of Cleveland, America.) Dated February 25. 6d. The object of this invention is to produce dynamo-electric machines so constructed that the current induced in the armature will be without wide breaks and nearly continuous, and also to increase the efficiency of the said machines. The invention consists in a dynamo-electric machine constructed with its field magnets made oblong in cross section, and arranged in two series in a circle around the armature shaft with the poles of the opposing series facing each other, and arranged at a sufficient distance apart to receive the armature between them, the poles of each series nearly overlapping each other laterally, forming a nearly continuous magnetic field; also in the armature constructed of a hollow iron ring nearly rectangular in cross section, and with its sides converging or inclined inwards from the periphery towards the inner side; also in the hollow ring armature made with corresponding openings in its periphery and inner sides, and projections of uniform thickness upon its inclined or converging sides, whereby the outer part of the armature is brought nearer to the magnetic field of force than the inner part; also in the hollow ring armature made with two series of projections of different shape alternating with each other, the projections of the one series being made V-shaped or with converging sides, and the projections of the other series being made with slightly inclined or converging sides and V-shaped ends, whereby

channels or grooves of uniform width are formed to receive the helix coils; also in the combination with the armature having lugs and the armature shaft of the hubs having flanges, whereby the said armature will be firmly connected with the said shaft; also in the combination with the armature and the armature shaft of the stationary magnet cores and the helices, the said cores being placed spirally around the armature shaft and at an inclination with the said shaft, and the said helices being wound with their coils parallel with the magnetic field of force, whereby the field of force will be elongated in the direction of the armature's movement, as will be hereinafter fully described. Fig. 1 is a sectional side elevation of one form of the machine taken through the line, *w*, *w*, fig. 2. Fig. 2 is a sectional end elevation of the same taken through the line, *v*, *v*, fig. 1. A is the bed plate of the machine; B B are two standards attached to the bed plate, A, and having bearings in which revolves the shaft, C, that carries the armature. The standards, B B, also form the seats and supports for the stationary magnet cores, E^2, around which are wound helices, F, of insulated copper wire. The magnet cores, E, stand with their axes in a spiral line of convenient direction and pitch around the axis of the shaft, C. With this arrangement the stationary magnet cores present an oblong field of force to the armature, the length of the field of force depending upon the pitch of the magnet cores, E, and their inclination from the axis of the shaft, C. The magnet cores, E, are arranged with the longest diameters of their fields of force in the direction in which the armature revolves, by which arrangement the projections of the armature will remain longer in the fields of force, and the generated currents will thus be considerably increased. One of the magnet cores, E, with the surrounding helix can be one pole of an electro-magnet, or two or more of the said cores, E, can be connected on their faces by a plate, and thus form only one pole of an electro-magnet. The series of magnets are arranged in circles around the shaft, C, one series being attached to each frame, B. The magnet cores, E^2, are made oblong in cross section, and are arranged in inclined positions with reference to each other, so that they nearly overlap each other laterally, the side of one magnet being tangential to the rounded edge of the adjoining magnet, and so on throughout the series. With this arrangement the face of the pole of each magnet is arranged diagonally across the path of the armature ring in the plane of its rotation. This construction brings the magnets into such positions that each section coil of the armature will pass upon the pole of each magnet at the instant it leaves the pole of the preceding magnet, so that the current induced in the armature will be without wide breaks and will be nearly continuous. With this construction the armature can be revolved in either direction.

FIG. 1.

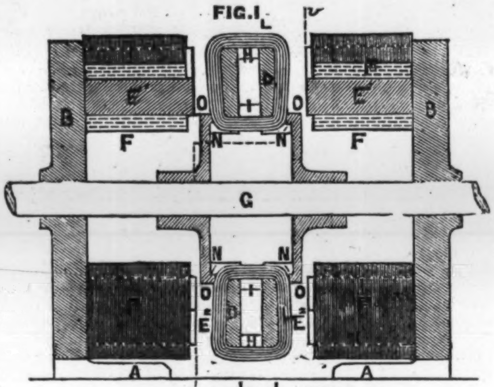
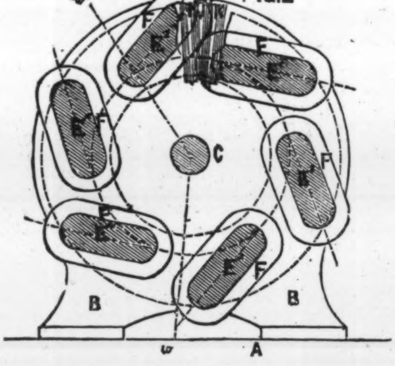


FIG. 2



THE ANGLO-AMERICAN TELEGRAPH COMPANY.—At a meeting of the board of directors, it was resolved, after placing £37,500 to the renewal fund, to declare an interim dividend for the quarter ending June 30th, 1882, of 15s. per cent. on the ordinary stock, and 30s. per cent. on the preferred stock, both free of income-tax, payable on August 1st, to the stock-holders registered on the books of the company on July 7th, 1882.

THE WESTERN UNION TELEGRAPH COMPANY.—This company has declared a quarterly dividend at the rate of 6 per cent. per annum upon its stock, payable on July 15th. The surplus proposed to be carried forward after payment of this dividend is unusually large.

EASTERN EXTENSION TELEGRAPH COMPANY.—A dividend of 2s. 6d. per share for quarter ended 31st March, will be payable on July 15th.

EASTERN TELEGRAPH COMPANY.—Notice is given that subject to the final audit, the accounts show, after placing the sum of £75,000 to reserve, a balance sufficient to pay the fixed dividend of 3s. per share, equal to 6 per cent. per annum on the preference shares, and a final dividend of 2s. 6d. per share, with a bonus of 1s. per share on the ordinary shares, both free of income-tax; making, with previous payments on account, a dividend for the year ending March 31st, 1882, of 5½ per cent. on the ordinary shares. A balance of about £1,000 is carried forward.

EASTERN AND SOUTH AFRICAN.—The interest on the 5 per cent. mortgage debentures now due will be paid by Messrs. Barclay, Bevan & Co.

CUBA SUBMARINE TELEGRAPH COMPANY.—The directors of this company state that, after providing for the dividend on the preference shares and placing £3,950 to the reserve fund, they have resolved to recommend the payment of a dividend on the ordinary shares at the rate of 8 per cent. per annum, free of income-tax, leaving £2,146 to be carried forward to the current half-year's account.

APPLICATION has been made to the Stock-Exchange Committee to appoint a special settling day in and to grant a quotation to the following securities:—Metropolitan Brush Electric Light and Power Company (Limited), and Railway Electric Appliances Company, shares.

QUOTATIONS have been granted to the Great Western Electric Light and Power Company, and to the Indian and Oriental Electric Storage and Works Company.

QUOTATIONS of the Brush Electric Light and Power Company of Scotland (Limited), has been deferred.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. July 5	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	25 -26	26.25½.6½.6.5½ .¾.½.6
		Do. Do.	10	45 - 50	
150,000	1	Electric Light and Power Generator Co.	1	¾- 1	
25,000	5	Great Western Electric Light & Power Co.	2	1½- 1¾	
24,980	5	Hammond Electric Light & Power Supply Co.	2½	10½- 11½	11½.11.10⅞
40,000	5	Indian & Oriental Electrical Storage Co.	2	2 - 2½	2¼
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	52 - 53	
2,441,800*l.*	Stk.	Do. Preferred } Def'd. receiving no div. until	100	82½ 83½	82½.3.2¼
2,441,800*l.*	Stk.	Do. Deferred } 6 p. c. has been paid to Pref.	100	22½- 23½	22¼
130,000	10	Brazilian Submarine, Limited	10	11⅜- 11⅝	11 7/16
16,000	10	Cuba, Limited	10	9¾- 10¼	
6,000	10	Do. 10 per cent. Preference	10	16 - 17	
13,000	10	Direct Spanish, Limited	9	6¼- 6¾	6¼
6,000	10	Do. 10 per cent. Preference	10	15½- 16½	
65,000	20	Direct United States Cable, Limited, 1877	20	11⅞- 12⅛	
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	101 -104	
380,000	10	Eastern, Limited	10	10⅛- 10⅜	10¼.5/16.3/16
70,000	10	Do. 6 per cent. Preference	10	13 - 13¼	13⅛.1/16.⅛.3/16
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	99 -102	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	102 -107	
199,750	10	Eastern Extension, Australasia & China, Limited	10	11 - 11¼	11¼.⅛.¼
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	100	106 -110	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	102 -105	xd.
140,000	100	Do. do. registered, repayable 1900	100	102 -105	xd.
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	102 -105	
254,300*l.*	100	Eastern and South African Limited 5 per cent. Mort. Deb. Registered redeemable 1 Jan. 1900	100	102 -105	xd.
345,700*l.*	100	Do. do. do. To Bearer	100	102 -105	xd.
22,050	10	German Union Telegraph and Trust, Limited	10	9¾- 10¼	
163,390	10	Globe Telegraph and Trust, Limited	10	6¼- 6½	
163,209	10	Do. 6 per cent. Preference	10	12¼- 12½	12 5/16.⅜
125,000	10	Great Northern	10	12½- 13	
100,000*l.*	100	Do. 5 per cent. Debentures	100	100 -103	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	25½- 26½	
100,000	100	Do. 6 per cent. Debentures, 1886	100	101 -105	
17,000	25	Indo-European, Limited	25	28 - 29	
38,148	10	London Platino-Brazilian, Limited	10	4½- 5	
12,000	10	Mediterranean Extension, Limited	10	2 - 2½	
8,200	10	Do. 8 per cent. Preference	10	8½- 9	
9,000	8	Reuter's, Limited	8	12¾- 13¼	
280,000	Stk.	Submarine	100	265 -275	
58,225	1	Do. Scrip	1	2⅜- 2⅝	
4,200	Cert.	Submarine Cables Trust	100	100 -105	
37,350	12	Telegraph Construction and Maintenance	12	29½- 30½	
150,000	100	Do. 6 per cent. Bonds, 1884	100	102 -104	103 xd.
186,750	5	Do. 2nd Bonus Trust Cert.	5	1½- 1¾	
30,000	10	West Coast of America, Limited	10	4¾- 5¼	
150,000	100	Do. 8 per cent. Debentures	..	..	
69,910	20	Western and Brazilian, Limited	20	6¾- 7¼	7
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	107 -112	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80, red. Feb., 1910	100	99 -102	
1,500	$1,000	Western Union of U. S. 7 p.c. 1 Mort. (Building) Bds.	$1,000	121 -126	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	102 -105	
88,321	10	West India and Panama, Limited	10	1½- 1¾	
34,563	10	Do. 6 per cent. 1st Preference	10	8 - 8½	8¼
4,669	10	Do. 6 do. 2nd do.	10	6½- 7	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	1⅜- 1⅝	1 7/16.½
200,000	1	Oriental Telephone Co., Nos. 100,000 to 300,000	½	⅜- ⅝	
100,000	5	United Telephone Co.	5	12¾- 13¼	12⅞.¾.⅞

The last prices on July 5th of Electric Light Shares not officially quoted were as follows:—Australasian, ¼ dis. to ¼ prem.; Eastern Electric Lights, 4 to 4½; Midland, ½ dis. to par; Scotch, 1 to 0½ dis.

EDISON ELECTRIC LIGHT COMPANY
(LIMITED).

The Public are informed that the above Company, whose registered Offices are at

74, COLEMAN STREET, E.C.,
ARE THE SOLE ASSIGNEES OF ALL
Mr. EDISON'S PATENTS FOR ELECTRIC LIGHT AND POWER
IN THIS COUNTRY.

The Company is advised that these Patents secure to it the sole right to manufacture and sell the INCANDESCENT LAMP consisting of a Carbon Filament in a Vacuum, under whatever name that Lamp may be known.

The Company is prepared to enter into Contracts for

LIGHTING HOUSES, FACTORIES, STREETS, AND TOWNS,
On any scale, and to grant concessions to District Companies for the use of the Patents.

CALLENDER'S
BITUMEN, TELEGRAPH AND WATERPROOF CO.,
LIMITED.
101, LEADENHALL STREET, LONDON. Works—ERITH, KENT.

Manufacturers of Insulated Wire for the Transmission of Electricity for all purposes,

TELEGRAPHS, TELEPHONES, ELECTRIC LIGHTING, TRANSMISSION OF POWER, &c.,
At a price greatly below that of Gutta-percha or India-rubber.

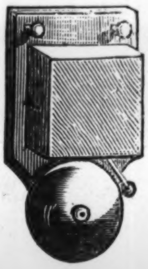
RAMSDEN, CAMM & Co
Iron & Steel Wire Drawers & Galvanizers
MANUFACTURERS OF PATENT TELEGRAPH WIRE TO GOVERNMENT SPECIFICATIONS
BEST REFINED TELEPHONE WIRE.
FENCING WIRE.
SUBMARINE CABLE WIRE.
STRAND & STAY WIRE AND GALVANIZED BINDING WIRE
TRADE MARK
ROBIN HOOD
RC & Co
B
OVER 100 Lb PIECES WITHOUT WELD OR JOINT
BRIGHOUSE
YORKSHIRE
CONTRACTORS TO H. M POSTMASTER GENERAL

London Offices—72, KING WILLIAM STREET. Agents, G. W. SHARE & Co.

J. ORME & CO.,

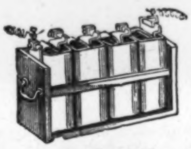
MANUFACTURERS & IMPORTERS.

ELECTRIC BELLS AND BATTERIES.



9/6

3/6 to 6/-



£1 15 0

£2 2 0

Every Description of Electrical Apparatus for Science Classes.

CARBON TRANSMITTERS

For use with Telephones, with Automatic Switch, &c., per pair, **£6 6 0.** Hunnings' Patent Carbon Transmitters, per pair **£5**

ILLUSTRATED PRICE LIST OF ELECTRICAL APPARATUS, POST FREE, THREE STAMPS.

Price List of Chemical Apparatus with 650 *Illustrations, post free,* 8 *stamps.*

J. ORME & Co. (Late M. JACKSON & Co.),
65, BARBICAN, LONDON, E.C.

SIR WILLIAM THOMSON'S
PATENT GRADED GALVANOMETERS.

MR. JAMES WHITE, 241, Sauchiehall Street, Glasgow, is now prepared to supply GALVANOMETERS constructed in accordance with Sir William Thomson's Patent, December, 1881. These instruments are portable Galvanometers of two classes: one designed for measuring electric currents and the other for measuring electric potential. The Current Galvanometer measures currents of from 0·01 of an ampère to 100 ampères. The Potential Galvanometer measures differences of potential from 0·1 of a volt to 200 volts.

PRICES.

Potential Galvanometer, with controlling magnets and flexible electrodes - -	**£20 0 0**
Current Galvanometer, ditto ditto - -	**15 0 0**

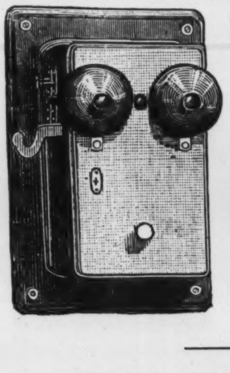
TO ELECTRICIANS.

WANTED, by the Birmingham and Warwickshire Electric Light and Power Company (Limited), a thoroughly competent PRACTICAL ELECTRICIAN.—Application to be made by letter to the Manager, 110, Cannon Street, E.C.

TO ELECTRIC LIGHT COMPANIES.

WANTED, a re-engagement by a PRACTICAL ELECTRICIAN, having a knowledge of several systems of electric light. Highest references.—Apply "Electron," care of Editor "ELECTRICAL REVIEW," 10, Paternoster Row.

PRIZE MEDAL, PARIS, 1881.



BLAKEY, EMMOTT, & Co.,
NORTHERN TELEGRAPH WORKS,
HALIFAX.

LONDON & PARIS.

Manufacturers of Magneto Call Bells, as used by the Principal Telephone Companies, also Switch Boards, Switches, and all Instruments for Telephone Work.

PRICES ON APPLICATION.

THE
RAILWAY SUPPLIES JOURNAL.
STORE-KEEPERS' GAZETTE;
Manufacturers', Inventors', and Contractors' Record; and Railway, Shipping, Tramway, & Mining Advertiser.

Principal Editions on the 1st and 15th of each Month. Price Sixpence.

THE RAILWAY SUPPLIES JOURNAL is specially intended to bring under the notice of Railway Companies the various inventions, improvements, and supplies demanded by the numerous requirements of the Railway Service; and generally to form a medium of communication between Railway Companies and those who supply them with materials, goods, or appliances.—*Times.*

OFFICE—
5, WINE OFFICE COURT, FLEET ST., LONDON, E.C.

NEWALL'S PATENT LIGHTNING CONDUCTORS.

As applied to all kinds of Buildings and Shipping in all parts of the world with unvarying success, are the most reliable, most effective, and cheapest conductors offered to the public.

SOLE PATENTEES OF UNTWISTED WIRE ROPE.

Manufacturers of Iron and Steel Ropes for Colliery and Railway Purposes, Rigging Ropes, Guide Ropes, Flexible Steel Towing Hawsers, &c.

COPPER ROPE CABLES OF HIGH CONDUCTIVITY FOR ELECTRIC LIGHT AND POWER.

GALVANISED SIGNAL AND FENCING STRAND. GILT AND SILVER CORD FOR HANGING PICTURES. IRON, STEEL, AND COPPER CORD FOR CLOCK AND SASH LINES, &c.

R. S. NEWALL & CO., LONDON, 130, STRAND, W.C.
LIVERPOOL, 36, Waterloo Road; GLASGOW, 68, Anderston Quay; MANUFACTORY, Gateshead-on-Tyne.

PHOTOGRAPHY
(RAPID DRY PROCESS).
PREVIOUS KNOWLEDGE NOT NECESSARY.

No Chemicals required in the field, Tourists' Pocket Camera and Slides for Plates 4¼ by 3¼. Lens, Patent Folding Stand, Chemical Laboratory, and every requisite.

Price Complete, £8 8s.

THE SAME SET FOR PICTURES 5 × 4, £9 9s.

PRACTICAL INSTRUCTION FREE.

Sensitive Plates 2s. 6d. per doz.

WRATTEN & WAINWRIGHT,
38, GREAT QUEEN STREET, LONG ACRE, W.C.

IMPROVED STEEL WIRE FOR ROPES.

WEBSTER, HORSFALL & LEAN
(ORIGINAL PATENTEES),

MANUFACTURERS OF IMPROVED STEEL WIRE FOR ROPES FOR COLLIERIES, RAILWAY INCLINES, PLOUGHS, HAWSERS, &c.

Sole Manufacturers of the Homogeneous Wire for the Atlantic Cables of 1865 and 1866.

WEBSTER, HORSFALL & LEAN, BIRMINGHAM.
N.B.—Noted for "Sounding" Wire for Deep-sea Sounding, Telephones, &c.

THE
LONDON ELECTRIC WIRE COMPANY,
WENLOCK BUILDINGS, IRONMONGER ROW, OLD STREET, LONDON, E.C.,

Manufacturers of Covered Wires of all descriptions for Electrical Instruments, Dynamo Machines, Bell & House work, &c.

Fancy Paraffined Wires specially prepared for Telephone and other indoor connections.

HARRISON, COX-WALKER & CO.,
DARLINGTON,
ELECTRICIANS, TELEPHONE AND PNEUMATIC ENGINEERS, MINING BELL MANUFACTURERS,
Agents for
HUNNINGS' PATENT MICRO-TELEPHONE TRANSMITTERS,

THE SCHOOL OF TELEGRAPHY AND ELECTRICAL ENGINEERING.

ESTABLISHED IN 1868.

12, PRINCES STREET, CORNER OF HANOVER SQUARE, LONDON, W.

(Removed from 4, George Street, Hanover Square). *Managing Director: Mr. T. J. JONES, M.S.T.E.*

The course of Practical and Theoretical Instruction in the higher branches of Overland and Submarine Telegraphy embraces, in addition to the manipulation of the various systems of wording in general use, the following subjects:—Mathematics, Mechanics, Chemistry, Gas, and other Motors, in relation to Telegraphy. Signalling and Testing Instruments. Engineering Formulæ and their application in practice. Electro-Statics. Electro-Dynamics. Magnetism. Methods of Testing the Electrical Condition of a Line during and after its Construction. Testing for and Localising Faults, &c., &c., &c. Telephone and Electric Light Apparatus.

The instruction, both in signalling and testing, is of a thoroughly practical character, as the classes work with the actual instruments used on long lines, through cables of various lengths, from 600 to 3,000 knots, so that the signals of the Eastern, Atlantic, and Brazilian Co.'s, &c., are exactly reproduced, and the pupils fitted for any line.

A complete practical and theoretical course of instruction on the TELEPHONE and the ELECTRIC LIGHT, and their commercial utilisation, has now been added to, and embodied in, the ordinary curriculum, as the advantages of being associated with any great commercial application of science at an early period of its development is one which has been so often exemplified that it can scarcely fail to be appreciated by those who have in view professional success.

That **TELEPHONIC** communication and **ELECTRIC LIGHTING** constitute such applications is sufficiently shown by their rapidly increasing progress; and therefore no pains or expense have been spared to place at the disposal of the pupils the technical and scientific instruction requisite to qualify candidates for the most important posts in connection with these new branches of electrical engineering. In order that the instruction in the erection, adjustment, testing, and working of **TELEPHONE** and **ELECTRIC LIGHT** circuits may also be thoroughly practical, complete working telephone exchanges upon the various systems in use in different countries have been fitted up; every kind of telephone, for both exchange systems and private lines, with all apparatus used therewith, is provided (in duplicate when possible, so that students may be able to dissect and reconstruct the same). The necessary tools and materials are available, and every facility is given for conducting experiments by the pupils desirous of so doing, and a similar course has been pursued with the **VARIOUS LAMPS** and **MACHINES**, &c., in the **ELECTRIC LIGHT** Department, so that pupils from the School are in a position to enter either of these new fields. Civil and mechanical engineers, sons of professional gentlemen, and others, will now have an opportunity of acquiring a knowledge of all the telegraphic systems of working, of the construction and management of land and submarine telegraphs, of telephone lines, systems and exchange, of the construction, erection, and management of electric light apparatus, testing wires, lines and materials employed, submarine cable testing, localising faults, &c., &c.

Arrangements have been made so that Inventors, Amateurs and others can now have every facility, with all necessary apparatus provided in private rooms, to compare, test or perfect any Inventions, Apparatus, &c., connected with Telegraphy, Telephony, and the Electric Light. The highest professional assistance can also be had.

Further particulars may be obtained on application to W. N. TIDDY, Secretary.

BARNEY'S TELEPHONE

(PATENTED.)

LOUDER & MORE DISTINCT

ARTICULATION THAN ANY OTHER TELEPHONE.

EXCLUSIVE RIGHTS

FOR DISTRICTS FOR SALE.

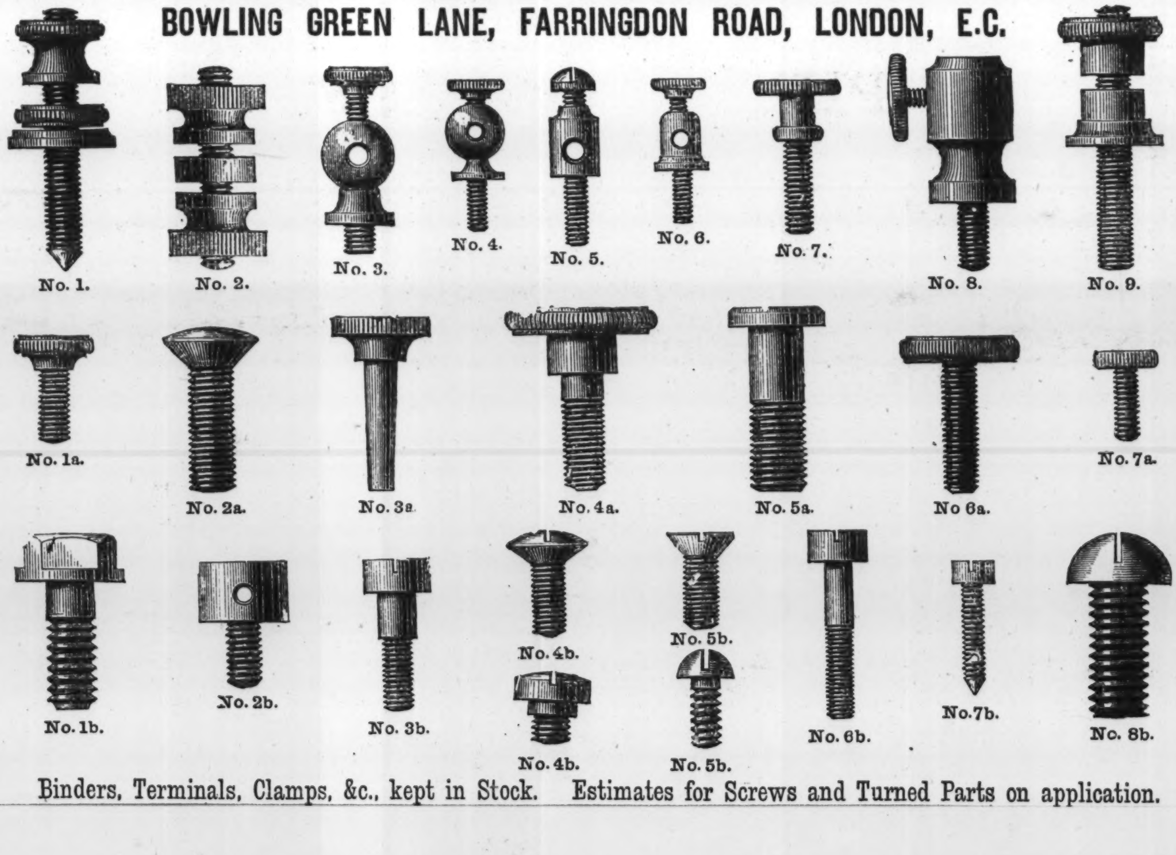
TELEPHONE RECEIVERS, WITH TWO ACOUSTIC TUBES, £10 PER PAIR.

Application to be made to W. C. BARNEY, *care of* H. AND E. J. DALE, 4, *Little Britain, London, E.C.*
Where the Instruments can be seen in operation.

DAVIS & TIMMINS,

Metal Screw Manufacturers,

BOWLING GREEN LANE, FARRINGDON ROAD, LONDON, E.C.


No. 1.
No. 2.
No. 3.
No. 4.
No. 5.
No. 6.
No. 7.
No. 8.
No. 9.
No. 1a.
No. 2a.
No. 3a
No. 4a.
No. 5a.
No 6a.
No. 7a.
No. 1b.
No. 2b.
No. 3b.
No. 4b.
No. 4b.
No. 5b.
No. 5b.
No. 6b.
No. 7b.
No. 8b.

Binders, Terminals, Clamps, &c., kept in Stock. Estimates for Screws and Turned Parts on application.

EDWARD PATERSON,
TELEGRAPH & ELECTRICAL ENGINEER,
St. Paul's Works—78, LITTLE BRITAIN, LONDON, E.C.,
AND
European Telegraph Works—POWNALL ROAD, DALSTON.
(PARIS AGENTS—E. & S. DELEVINGNE, 8, RUE MARTEL, PARIS.)
Prize Medal, International Electrical Exhibition, Paris, 1881.
MANUFACTURER OF
Telephones, Transmitters, Switchboards,
AND ALL ACCESSORIES FOR
TELEPHONE EXCHANGES.
Electric Signals for Mines, Houses, Ships, &c. Block and Needle Instruments for Railways.
Silk and Cotton covered Wires; Rubber covered Wires for [illegible] Lights.
THE DOUBLE INDUCTION MOTOR FOR [illegible], &c.
Batteries, Insulators, and other Telegraph Stores. Continuous Copper Band Lightning Conductors.

AYRTON & PERRY'S
Instruments for Electric Light Measurements.
Ammeter.
Ohmmeter.
Voltmeter.
Electric Power Meter.

AYRTON & PERRY'S
Dynamometer Coupling.
Dispersion Photometer.

THE GOWER-BELL
LOUD SPEAKING TELEPHONE.
As adopted by Her Majesty's Government.

ELECTRIC LIGHT LEADS, GUTTA-PERCHA, INDIA-RUBBER, COMPOUND BRAIDED COTTON, SILK COVERED WIRES.

SPECIAL WIRES FOR DYNAMO MACHINES.

PHILLIPS BROS.,
ELECTRICAL WIRE MANUFACTURERS,
MACINTOSH LANE, HOMERTON,
LONDON.
ESTABLISHED 1870.]

SPECIAL WIRES FOR INCANDESCENT LAMPS.

GERMAN SILVER WIRES FOR HIGH RESISTANCES, FLEXIBLE CORDS, TELEPHONE WIRES, &c., &c. MULTIPLE, AERIAL, AND SUBTERRANEAN CABLE WIRES TO ANY SPECIFICATION.

GOLD MEDAL, 1881, PARIS ELECTRICAL EXHIBITION.

THE "PILSEN"-JOEL AND GENERAL ELECTRIC LIGHT COMPANY,
LIMITED.

PATENTEES AND MANUFACTURERS OF
THE PILSEN ARC LAMP, THE JOEL SEMI-INCANDESCENT LAMP, AND THE GATEHOUSE INCANDESCENT LAMP.

Manufactory: THE MALDEN FACTORIES, KENTISH TOWN, N.W.,
H. F. JOEL, A.M.I.C.E., Engineer.
E. T. GREGORY, Secretary. JAMES FYFE, Managing Director.

TEMPORARY OFFICES—52, QUEEN VICTORIA STREET, E.C.

Contractors to H.M. Postmaster-General, the Indian Government, the principal Railway, Telephone, and Electric Light Companies.

ESTABLISHED 1868.

WALTER T. GLOVER & Co.,
Telegraph Wire and Cable Makers,
25, BOOTH STREET, MANCHESTER.

INDEX TO THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW ADVERTISEMENTS.

No charge is made for inserting the Names of firms whose advertisements are ordered for a series of insertions in this Journal during the continuance of such advertisements.

(The numbers refer to the page on which the displayed advertisement will be found.)

PAGE
Cabinet Work.
G. Beech 8
W. M. Foxcroft 3
Clock Synchronising.
Barraud & Lunds... 6
Educational.
School of Telegraphy 10
Electrical Engineers and Contractors.
Callender's Bitumen Telegraph, &c., Co. 7
W. T. Henley 5
Hooper & Co. 1
India-rubber and Telegraph Works Co. 12
Johnson & Phillips 1
E. Paterson 11
Electric Light.
[illegible] & Co. (Swan) 5
Edison Electric Light Co., Limited ... 7
Griffith & Co. 4
Pilsen-Joel and General Electric Light Company, Limited 2

PAGE
Engines for Electric Light.
Peter Brotherhood 6
Insulators.
Bourne & Co. 5
David Brooks 5
G. Johnson & Sons 4
Stiff & Sons 4
Lightning Conductors.
Newall & Co. 9
Machinery.
Thos. Barraclough & Co. (Limited) ... 5
Manufacturing Electricians.
T. Crampton & Co. 4
H. & E. J. Dale 4
J. T. Gent & Co.... 4
J. Orme & Co. 6
F. A. Stevens 2
Patent Agents.
E. P. Alexander 6
H. Gardner 2
Publications.
Berly's "Electrical Directory" ... 3
"Railway Supplies Journal" 9

PAGE
Screws.
Davis & Timmins... 10
International Machine Company ... 4
Telephones.
W. C. Barney 10
Blakey, Emmott & Co. 8
Harrison, Cox-Walker & Co. 9
Swiss Telephone Company 11
M. Theiler & Sons 6
Wood Engraver.
R. A. Cheffins 4
Wire (covered).
W. T. Glover & Co. 2
London Electric Wire Company ... 9
Phillips Brothers 11
Wire (uncovered).
Cooke & Co. 5
R. Johnson & Nephew 2
Ramsden, Camm, & Co. 7
F. Smith & Co. 2
Webster, Horsfall & Lean 2